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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 14, NUMBER 10
MAY 15, 1981

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A semimonthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

VOLUME 14, NUMBER 10
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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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2A. General

WATER RESOURCES OF THE COOK INLET BASIN, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-01671

MAN OUTMATCHES MATH MODELS FOR FLOOD FREQUENCY,
Pima County Flood Control Districts, Tucson, AZ.
B. M. Reich.
Public Works, Vol 111, No 7, p 56-57, July, 1980. 1 Fig, 2 Tab.

Descriptors: *Graphical analysis, *Flood forecasting, *Mathematical models, Streamflow, Analytical techniques, Graphical methods, Flood protection, Flood data, Flow rates, Flood control.

A mathematical graphical method is described, based on sound statistical reasoning, that can be used to make estimates of the 100-year flood. The largest and smallest estimates obtained by 31 students with this method were 9,200 and 7,000 cfs for this example using 20 yr of good flood data from a 57.7 square mile watershed in Southeastern Arizona. Five common mathematical models were used for the same estimates, and the Q-100 values thus obtained ranged from 5,540 to 60,870 cfs from the same flood series. (Baker-FRC)
W81-01882

2B. Precipitation

DROUGHT AND OUR DESTINY,
T. C. Robertson.
Veldtrust (Johannesburg), p 4-7, Autumn, 1979.

Descriptors: *Droughts, *Africa, *Hydrologic budget, *Precipitation(Atmospheric), *Climatic data, Climates, Climatic zones, Effective precipitation, Climatology, Geographical regions, Regions, Foreign countries, Subtropic, Tropic, Meteorology, Water shortage, Water utilization, Rainfall, Weather forecasting, Probable maximum precipitation, Floods, Weather data, Moisture deficit, Vegetation effects, *South Africa.

A historical account is given concerning numerous attempts (since 1914) to give a scientific explanation of the problems posed by seasons of diminished rainfall in South Africa. The Drought Investigation Commission and the Select Committee of the Senate, which investigated droughts/rainfall/soil erosion in 1914, felt that if high/low rainfall cycles occurred, it should be possible to locate and predict them. In 1934 Schumann and Thompson divided the country into 32 rainfall districts and collected all weather data recorded during the past 55 years. In 1965, Midgley produced a runoff hydrograph (showing tall peaks of the 1943 and 1954 floods, and graph valleys for the 'great four years drought' (1930-1933)) for the river at Vaaldam. Worthington felt prior to the recent severe drought in the Sahel region, that the drought-striken parts of Africa might experience extensive depopulation during a prolonged cycle of drier years. An exhaustive 8-year analysis of rainfall statistics dating back to 1910 generated a graph indicating 10-year cycles of 20-30% higher to 20-30% lower rainfall than average. The country reached the peak of wet period by 1976 and is now on the decline to fall below average by 1981. (Zielinski-IPA)
W81-01750

2C. Snow, Ice, and Frost

COLUMBIA GLACIER, ALASKA: RECENT ICE LOSS AND ITS RELATIONSHIP TO SEASONAL TERMINAL EMBAYMENTS, THINNING, AND GLACIAL FLOW,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-01672

2D. Evaporation and Transpiration

EVAPORATION FROM A SPHAGNUM MOSS SURFACE,
North Central Forest Experiment Station, Grand Rapids, MN.
D. S. Nichols, and J. M. Brown.
Journal of Hydrology, Vol 48, p 289-302, November, 1980. 2 Fig, 2 Tab, 38 Ref.

Descriptors: *Evaporation, *Evapotranspiration, *Mosses, Peat, Energy budget, Wetlands, *Bogs, Hydrologic cycle, Temperature, Vapor pressure, Solar radiation, Minnesota, Great Lakes Region, *Sphagnum, Bowen ratio.

Peat cores, 45 cm in diameter, were collected from a sphagnum bog in northern Minnesota, and used to measure the effects of different temperatures and water levels on evaporation from a sphagnum moss surface in a growth chamber. Under all conditions, evaporation from the moss surface was greater than that from a free-water surface. Evaporation from the moss increased 92% as the temperature was raised from 9 to 25C. The energy used in evaporation from the moss exceeded net radiation except at 9C. Evaporation from the moss was less when the water level was at the surface of the peat than when it was lowered to 5, 10, or 15 cm below the surface. The presence of an overstory of grasses and sedges protected the moss from desiccation when the water level was 15 cm below the surface, but had no effect on total water vaporization at any water level. When the peat cores were maintained in the greenhouse for a year, changes in either the peat, the moss, or both occurred which resulted in significantly lower evaporation when measured in the growth chamber.
W81-01738

2E. Streamflow and Runoff

FLOW CHARACTERISTICS OF NEW MEXICO STREAMS, PART I. FLOW DURATION,
Geological Survey, Albuquerque, NM. Water Resources Div.
L. J. Reiland.
New Mexico State Engineer Special Report, 1980. 115 p, 9 Fig, 4 Tab, 2 Ref.

Descriptors: *Flow characteristics, *Streams, *Flow duration, Data collections, *Streamflow, New Mexico, Colorado, Oklahoma, Discharge(Water), Natural flow, Gaging stations, Sites.

Flow-duration tables have been developed from daily streamflow records collected at 156 gaging stations in New Mexico and parts of Colorado and Oklahoma. These tables show the percentages of time that various daily discharges were equaled or exceeded. Records for 32 long-term gaging sites having virtually natural flows were selected as index stations. By correlation with the long-term records, flow-duration data obtained at 70 short-term stations have been extended in time to represent data for a 43-year base period, 1931-73. Flow-duration data obtained at eight short-term stations have been extended to represent data for a 39-year base period, 1935-73. For 38 stations flow-duration tables are presented only for the period of record, there being no reliable basis for extending the record. (USGS)
W81-01667

STATISTICAL SUMMARIES OF SELECTED STREAMFLOW DATA--SOUTH PLATTE RIVER IN COLORADO AND NEBRASKA; NORTH PLATTE AND PLATTE RIVERS IN NEBRASKA,
Geological Survey, Denver, CO. Water Resources Div.
H. E. Petsch, Jr., K. B. Rennick, and C. F. Nordin, Jr.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225. Geological Survey Open-File Report 80-679, 1980. 278 p, 1 Fig, 3 Ref.

Descriptors: *Hydrologic data, *Streamflow, *Data collections, *Colorado, *Nebraska, Surface waters, Runoff, Gaging stations, Sites, Flow characteristics, Discharge(Water), *South Platte River(CO-NE), *North Platte River(NE), Platte River(NE).

This report is a compilation of statistical summaries of streamflow data for 22 gaging stations on the South Platte River in Colorado and Nebraska, and the North Platte and Platte Rivers in Nebraska. (USGS)
W81-01676

RESISTING THE DROUGHT,
T. C. Robertson.
Veldtrust (Johannesburg), p 7-9, Autumn, 1979.

Descriptors: *Drought, *Drought resistance, *Agroclimatology, *Africa, *Farm management, Hydrologic budget, Precipitation(Atmospheric), Environmental effects, Arid lands, Agriculture, Moisture deficit, Effective precipitation, Climates, Climatic zones, Climatology, Geographical regions, Regions, Foreign countries, Meteorology, Water shortage, Water utilization, Probable maximum precipitation, Groundwater, *South Africa.

An exhaustive 8-year analysis of rainfall statistics dating back to 1910 generated a graph indicating 10-year cycles of 20-30% higher to 20-30% lower rainfall than average. South Africa reached the peak of wet period by 1976 and is now on the decline to fall below the average rainfall level by 1981. The practical use to which farmers can put this knowledge is discussed. The author discusses soil erosion and various attempts undertaken since 1914 to create a public awareness of the drought problem. The 1923 'Blue Book' report and van Reenen's 1935 book, 'Resisting Drought', are discussed, calling attention to soil conservation, and factors as overgrazing, 'fodder banks', and burning the veld. The idea of conquering the dongas has been uppermost in the minds of soil scientists/engineers for many years and large-scale engineering attempts were made at Vlekpoort to 'cure' dongas. The new discipline of 'bioclimatology' (study of climate effects on life), and the science of agro-meteorology have provided advice to farmers to prepare against drought. (Zielinski-IPA)
W81-01749

DROUGHT AND OUR DESTINY,
For primary bibliographic entry see Field 2B.
W81-01750

AGRICULTURAL RUNOFF DURING A DROUGHT PERIOD,
Science and Education Administration, Lincoln, NE.
J. S. Schepers, E. J. Vavricka, D. R. Anderson, H. D. Wittmuss, and G. E. Schuman.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 711-719, April, 1980. 3 Fig, 7 Tab, 30 Ref.

Descriptors: *Runoff, *Agricultural watersheds, *Droughts, Precipitation(Atmospheric), Sediment transport, Sediment load, Nutrients, Water quality, Coliforms, Nebraska.

Basic research on agricultural runoff during a dry period is supplemented with specific examples from a 2025-ha agricultural water shed. Runoff from the Dee Creek watershed in Nebraska was analyzed over a three-year period of less than normal precipitation. Runoff amounted to less than 2% of the incoming moisture, and sediment losses were less than 0.7 metric ton/ha-year. Nutrient losses associated with the sediment averaged 74% of the total N losses and 76% of the total P losses. Nutrient loss was not consistently related to fertilizer application. The results of this study are in line with data in the literature which suggest that nutri-

ent discharge is highly dependent upon sediment loss. Water quality of the runoff was also determined. Over 90% of the samples collected exceeded recommended recreational water quality standards for total coliforms and fecal coliforms. Base flows exceeded the same standards 90% of the time for total coliforms and 45% of the time for fecal coliforms. (Small-FRC)
W81-01788

APPROXIMATE METHOD FOR QUICK FLOOD PLAIN MAPPING,
Army Engineer District, Mobile, AL.
R. F. Powell, L. D. James, and D. E. Jones.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 103-122, March, 1980. 11 Fig, 5 Tab, 3 Ref.

Descriptors: *Flood forecasting, *Flood routing, *Flood profiles, Flood data, Flood plains, Mapping, Curves, Mathematical studies, Estimating, *Flood plain mapping.

An approximate method is presented for mapping flood hazard in locations where normal flood hazard mapping has not been completed or would be too expensive. The method is based on normalized curves which can be used with often readily available information on 10 and 25 year floods to estimate large floods. These estimations can be used in flood warning systems or for structural design or regulatory purposes. The results can also be used to verify mapping efforts. If the discharges of two flood frequencies of common occurrence and the shape of the flood frequency curve are known, the information on the two floods can be extrapolated to estimate the discharge for less frequent flood discharges. Annual flood peaks are assumed to follow the log Pearson Type II distribution recommended by the Water Resources Council. The skewness of the data is calculated. Normalized state curves are used which incorporate the effects of the shape and roughness of the flood plain cross sections, stream slope, and other factors that influence the stage-discharge relationship. (Small-FRC)
W81-01837

OPTIMAL CONTROL OF UNSTEADY COMBINED SEWER FLOW,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. W. Labadie, D. M. Morrow, and Y. H. Chen.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 205-223, March, 1980. 8 Fig, 2 Tab, 23 Ref.

Descriptors: *Storm runoff, *Overflow, *Sewers, Computer models, Optimization, Water pollution sources, Runoff forecasting, Routing, Control, *Combined sewers.

Computerized control of stormwater runoff and combined sewer overflows is discussed. Combining realistic unsteady flow routing with optimization techniques for determining operating policies is one of the challenges of the computerized approach. Untreated overflows must be avoided or at least regulated in time to minimize pollution impacts. The Marina branch of the planned North Shores Outfalls Consolidation Project in San Francisco is presented as a case study. Here a fully dynamic, unsteady flow model was included within a deterministic dynamic programming formulation of the control problem. Orthogonal polynomials were used. This system showed significant savings in computer time and computer storage requirements over incremental dynamic programming solutions. The algorithm used rapidly determines improved control policies. This technique may be feasible for actual real time use. (Small-FRC)
W81-01838

MAN OUTMATCHES MATH MODELS FOR FLOOD FREQUENCY,
Pima County Flood Control Districts, Tucson, AZ.
For primary bibliographic entry see Field 2A.
W81-01882

BROOK RECHANNELING DEMANDS INTER-AGENCY COORDINATION,
W. A. Farrell.
Public Works, Vol 111, No 8, p 70-72, August, 1980. 1 Fig.

Descriptors: *Flood control, *Water management(Applied), Flow control, *Channeling, Flooding, *Flood routing, Flood protection, Flood plain zoning, Chutes, Civil engineering, Floodproofing, Watershed management, Connecticut, Trout Brook Channel(CT).

Plans are outlined for the reconstruction of 10,000 feet of Trout Brook Channel, a tributary of the Park River Watershed on the flood plain of the South Branch, located near West Hartford, Connecticut. The adjacent flood plain will accommodate floods which now inundate a sizeable residential area on an average of once/year. The plan involved the cooperation of all three levels of government along with public and private utilities. Cooperation was needed among the State Department of Environmental Protection, Soil Conservation Service of the USDA, State Department of Transportation, engineering firms, metropolitan district commissions, Connecticut natural gas company, Hartford Electric Light Company, Southern New England Telephone Company, and Hartford Cable Television. When completed the project will have cost several millions of dollars and should eliminate the recurring flood damage. (Baker-FRC)
W81-01884

2F. Groundwater

HYDROLOGY AND MODEL STUDY OF THE PROPOSED PROSPERITY RESERVOIR, CENTER CREEK BASIN, SOUTHWESTERN MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
E. J. Harvey, and L. F. Emmett.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A089782, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigation 80-7, June, 1980. 50 p, 16 Fig, 4 Tab, 17 Ref.

Descriptors: *Multiple-purpose reservoirs, *Groundwater, *Model studies, *Karst, *Missouri, Hydrogeology, Limestones, Underground streams, Water wells, Water yield, Mine drainage, Water quality, Water analysis, *Jasper County(MO), Center Creek basin(MO), Oronogo-Duenweg Belt(MO).

A reservoir has been proposed on Center Creek, Jasper County, southwestern Missouri. Groundwater levels in the limestone uplands adjacent to the reservoir will rise when the impoundment is completed. The site is a few miles upstream from the Oronogo-Duenweg belt in the Tri-State zinc district. Grove Creek joins Center Creek downstream from the reservoir separating it from the mining belt. A model study indicates water-level rises varying from about 20 feet near the reservoir to 0.5 to 1.0 foot in the southern part of the Grove Creek drainage basin. A significant rise in the water table adjacent to the reservoir could increase mine-water discharge if Grove Creek is not an effective drain. However, it is probable that Grove Creek is an effective drain, and the higher groundwater levels in the reservoir area will increase ground-water discharge to Grove Creek, and in turn, Center Creek. The increase in ground-water discharge to Grove Creek will have the beneficial effect of diluting mine-water discharge from the Oronogo-Duenweg belt during periods of low flow. (USGS)
W81-01660

SULFATE REDUCTION IN GROUND WATER OF SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 5A.
W81-01662

GROUND WATER IN THE THOUSAND OAKS AREA, VENTURA COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-01669

CHARACTERISTICS OF THE GROUNDWATER SEEPAGE INTO GREAT SOUTH BAY,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
H. J. Bokuniewicz, and M. J. Zeitlin.
Special Report 35, March 1980. 32 p, 14 Fig, 2 Tab, 22 Ref, Append.

Descriptors: *New York, *Groundwater movement, *Seepage, *Water sources, Pore water, Aquifers, Bays, Subsurface flow, Coastal areas, Discharge movement, Discharge(Water), Freshwater, Hydrography, Saline water-freshwater interfaces, Outflow, *Great South Bay(NY).

The submarine outflow of groundwater across the floor of Great South Bay in New York contributes fresh water to the Bay. The groundwater flow is especially important in Great South Bay for maintaining water quality and for supporting the hard clam industry. This study measures the source directly and is the first study of the submarine outflow into Great South Bay or into any body of coastal water. Preliminary work showed that much of the seepage occurred within 100 meters of the shore. Submarine outflow rates were as high as 150 liters/day per square meter. Outflow near the shore was typically 50 liters/day per square meter and decreased to about 30 liters/day per square meter at a distance of 100 meters offshore. The typical value of the submarine outflow was calculated to be 4.1 x 10 to the 8th power liters per day. This calculation excluded measurements made near Fire Island, but suggests that significant amounts of groundwater may enter the bay far from shore due to sustained upward leakage from deep aquifers. As a result, the calculated value is an underestimate. It was also found that the flow rate tended to vary with coastal flooding and rainfall. The outflow rates are relatively large and should significantly affect the pore water chemistry. (Garrison-Omniplan)
W81-01741

2G. Water In Soils

THE VARIATION OF IN SITU MEASURED SOIL WATER PROPERTIES WITHIN SOIL MAP UNITS,
Department of Agriculture, Ottawa (Ontario). Land Resource Research Inst.
G. C. Topp, W. D. Zebchuk, and J. Dumanski.
Canadian Journal of Soil Science, Vol 60, No 3, p 497-509, August, 1980. 8 Fig, 3 Tab, 10 Ref.

Descriptors: *Hydraulic conductivity, *Soil texture, *Soil water, Adsorption, Soil types, Porosity, Pore water, On-site tests, Cores, Soil profiles, Geographical regions, *Canada, Soil investigations.

The in situ saturated hydraulic conductivities of nine soil units from the Ottawa-Carleton region were recorded, and core samples were taken at each site for laboratory tests to determine desorption water capacity relationships. For the coarse- and fine-textured soils, similar hydraulic conductivities were found, which were higher than those observed for the medium textured soils. However, measurably different desorption curves were found for each of the coarse- and fine-textured soil units examined. Variability of hydraulic conductivity duplicate measurements at the sites was found to be much less than that of the soil unit as a whole. Two separate groups of soil with significantly different hydraulic conductivities were discerned. A third, intermediate group was also recognized which was not significantly different from the other two groups. Desorption curves were studied

in relation to means of identifying proportions of pore space attributable to structural pores or textural pores and differences in pore size distributions. (Geiger-FRC)
W81-01782

MODELING INFILTRATION,
Bidnan Chandra Krishi Viswa Vidyalaya, Kalyani (India). Dept. of Agricultural Engineering.
R. K. Ghosh.
Soil Science, Vol 130, No 6, p 297-302, December, 1980. 1 Fig, 4 Tab, 10 Ref.

Descriptors: *Mathematical models, *Infiltration, *Soil water movement, Model studies, Hydraulic conductivity, Hydrologic properties, Lewis-Kostiakov equation, Philip's equation, Equations.

A model for infiltration, combining the Lewis-Kostiakov equation and Philip's two-term infiltration equation, is proposed: I = (a times t to the b power) + (K sub s times t), where I = total quantity of water infiltrated, a and b are variables, t = time, and K sub s = saturated hydraulic conductivity of the soil. Comparisons with experimental and calculated data show that results agree over a complete range of times and that the equation is especially suited for long periods, for example, 72 hours. (Cassar-FRC)
W81-01847

2H. Lakes

HEAT TRANSFER IN IRRADIATED SHALLOW LAYERS OF WATER,
Purdue Univ., Lafayette, IN. School of Mechanical Engineering.
M. Behnia, and R. Viskanta.
Paper AIAA-80-1519 presented at AIAA 15th Thermophysics Conference, July 14-16, 1980, Snowmass, Colorado. 8 p, 9 Fig, 15 Ref. American Institute of Aeronautics and Astronautics, New York, NY. OWRT B-077-IND(6).

Descriptors: *Heat transfer, *Temperature distribution, *Radiation, Solar radiation, Thermal radiation distribution patterns, Energy transfer, Irradiation, Ponds, *Thermal stratification, Salinity, Shallow water.

The paper reports on an experimental and analytical investigation of temperature structure in a shallow layer of water heated by an external radiation source. Experiments have been performed in a test cell of known bottom reflection characteristics and suitable for optical observations. A shadowgraph and a Mach-Zehnder interferometer were used to visualize and measure the unsteady temperature profile in the water during irradiation. Experimental results obtained show that absorption of radiant energy by the substrate and/or by the water near the bottom results in an unstable situation and that natural convection flow develops. However, with continued heating the flow is suppressed. Analytical results, supported by the data, indicate that the spectral radiation characteristics of the bottom, and the depth of the water have a decisive influence on the temperature distribution.
W81-01697

LAKE KINNERET: CARBON FLOW PATTERNS AND ECOSYSTEM MANAGEMENT,
Isreal Oceanographic and Limnological Research Ltd., Tiberias.
C. Serruya, M. Gophen, and U. Pollingher.
Archiv fur Hydrobiologie, Vol 88, No 3, p 265-302, April, 1980. 14 Fig, 8 Tab, 85 Ref.

Descriptors: *Food webs, *Carbon, *Zooplankton, Phytoplankton, Seasonal, *Ecosystems, Productivity, Fish food organisms, Cycles, Food chains, Lakes, Israel, *Lake Kinneret(Israel).

As part of a series of studies to establish the energy budget of Lake inneret (Israel), different food web strategies were observed and analyzed quantitatively in terms of carbon flow. Over a ten year period, three main patterns of carbon flow were observed: the Peridinium, the nannoplankton, and the nannoplankton-sardine patterns. Carbon inputs of Lake Kinneret were mainly from internal sources. A maximum of 12% of the total carbon input during rainy winters and approximately 4% during summers is carbon channelled toward sedimentation. This factor severely limits the development of benthic fauna. Fifty percent of the total planktic carbon productivity in winter results from zooplankton eating Peridinium. In spring, the nannoplankton-zooplankton foodchain becomes dominant. The lake accumulates organic carbon in the winter-spring, and the resulting reserves are used in summer to cover the high maintenance requirements of the community. A condition of zero net production prevails in summer, which is suboptimum for fish. (Small-FRC)
W81-01777

LIMNOLOGICAL STUDIES ON LAKE PAMVOTIS (IOANNINA), GREECE, I. HYDROCLIMATOLOGY, PHYTOPLANKTON-PERIPHYTON WITH SPECIAL REFERENCE TO THE VALENCY OF SOME MICROORGANISMS FROM SULPHURETA AS BIOINDICATORS,
Athens Univ. (Greece). Inst. of Systematic Botany.
K. Anagnostidis, and A. Economou-Amilli.
Archiv fur Hydrobiologie, Vol 89, No 3, p 313-342, July, 1980. 5 Fig, 2 Tab, 116 Ref.

Descriptors: *Phytoplankton, *Periphyton, Aquatic life, Limnology, Lakes, Water quality, Bioindicators, Greece.

Phytoplankton and periphyton from Lake Pamvotis, Greece, were studied as part of a series of studies on the limnology and water quality of the lake. Lake Pamvotis is located in the northwestern part of Greece, about 1 km from Ioannina. Information is presented on the microflora investigations of Greek lakes, the geomorphology and climate of the Lake Pamvotis area, and a flora analysis of the phytoplankton and periphyton collected during 1967 and 1970. From the samples collected, 292 taxa were identified: 42 bacteria, 83 Cyanophyta, 78 Chlorophyta, 67 Bacillariophyta, 3 Chrysophyta, 9 Euglenophyta, 2 Xanthophyta, 3 Pyrrhophyta, 6 Mycophyta. All taxa found are listed, and their habitat is described. Most of the investigated biotopes were characterized as sulfidic. Forty-six species of sulfur bacteria, iron bacteria, and apochlorotic Cyanophyta were included in the saprobic systems as bioindicators. (Small-FRC)
W81-01789

2J. Erosion and Sedimentation

THE VOLUME OF SAND AND GRAVEL RESOURCES IN THE LOWER BAY OF NEW YORK HARBOR,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
H. J. Bokuniewicz, and C. T. Fray.
Special Report 32, December, 1979. 34 p, 8 Fig, 2 Tab, 20 Ref, Append.

Descriptors: *New York, *Sands, *Gravels, *Harbors, *Sediments, Sediment density probes, Silts, Seismic properties, Mud, Mud-water interfaces, Marine geology, Sedimentation, Hydrogeology, Marine geology, Particle size, Resources.

To guide future exploration and management of submarine sand resources, four types of information were studied in the shallow (<100-foot) stratigraphy of the Lower Bay floor: (1) core and boring logs, (2) seismic reflection profiles, (3) surficial sediment distribution on the floor of the Lower Bay, and (4) the stratigraphy in Long Island, Staten Island, northern New Jersey and the New York Bight. The study was designed to identify potential mining areas so surficial layers were given particular attention. In general, marine sands overlie glacial outwash sands which, in turn, overlie unconsolidated Cretaceous sediments. Along the margins of the Bay, sands are known to rest on fine-grained deposits at depth; the composition of layers underlying the surficial sand deposits in the central and eastern Bay is unknown. Surficial mud deposits are confined primarily in the Rariran and Sandy Hook Bays, and may be as much as 150 feet thick. Sand deposits were identified that have a total volume of 3,429 million cubic yards. Sand and gravel resources for mining are plentiful, but not all of them can be exploited. Submarine mining must coexist with such other uses as shipping, fishing, and recreation; environmental effects must be considered; and not all of the available sand and gravel is of usable quality. Further study is needed to establish acceptable mining zones and regulations. (Garrison-Omniplan)
W81-01740

WAVE INFLUENCES ON RIVER-MOUTH DEPOSITIONAL PROCESS: EXAMPLES FROM AUSTRALIA AND PAPUA NEW GUINEA,
Sydney Univ. (Australia). Dept. of Geography.
For primary bibliographic entry see Field 2L.
W81-01872

2K. Chemical Processes

CHEMICAL AND PHYSICAL CHARACTERISTICS OF PRECIPITATION AT SELECTED SITES IN FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. A. Irwin, and R. T. Kirkland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-159949, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-81, 1980. 70 p, 6 Fig, 2 Tab, 36 Ref.

Descriptors: *Chemistry of precipitation, *Precipitation(Atmospheric), *Water quality, Water analysis, *Florida, Data collections, Sampling, Sites, Baseline studies, Specific conductivity, Calcium, Sodium, Clorides, Hydrogen ion concentration, Nitrogen, Phosphorus, Iron, Lead.

Infrequent sampling of precipitation in Florida has been conducted by the U.S. Geological Survey since 1965. A summary of the historical data from 24 sites throughout Florida indicate that the principal ionic composition of atmospheric precipitation samples is calcium-sodium and bicarbonate-chloride with an average specific conductance of 32 micromhos per centimeter at 25 C. Historically, much of the sampling focused on primary nutrients and selected trace elements. Historical data indicate that nitrogen and phosphorus concentrations averaged 1.1 and 0.1 milligrams per liter, respectively. The limited trace metal data indicate that motor-vehicle activity may have a significant impact on local precipitation quality. Lead, for example, was measured in concentrations of as much as 2,400 micrograms per liter in samples collected in a highly populated, commerical area in south Florida. Statistical testing indicated that most major inorganic constituents, primary nutrients, and trace metals were significantly differnet among the sampling sites. The pH data indicated a range of about 5.0 to 7.0, but only limited pH data were collected and analyzed at the historical sites in such a timely manner as to represent pH conditions of the atmospheric precipitation during active rainfall. A critical review of the historical data suggested that while they may reflect local atmospheric quality conditions they likely do not define baseline conditions from a regional perspective. The application of these data were generally limited regarding regional extrapolation due to lack of standardization of sampling techniques, variable methods of sample preservation, nonuniform sampling intervals, variable sample sizes, and different periods of record. (USGS)
W81-01666

2L. Estuaries

ECOLOGY OF SOUTHERN AFRICAN ESTUARIES. PART XI. MNGAZANA: A MANGROVE ESTURARY IN TRANSKEI,
Cape Town Univ. (South Africa). Dept. of Zoology.
G. M. Branch, and J. R. Grindley.
South African Journal of Zoology (Pretoria), Vol

14, No 3, p 149-170, 1979. 16 Fig, 11 Tab, 25 Ref, 2 Append.

Descriptors: *Estuaries, *Estuarine environment, *Africa, *Ecology, *Chemical analysis, Water analysis, Biomass, Physical properties, Bodies of water, Aquatic habitats, Aquatic environment, Balance of nature, Ecosystems, Geographical regions, Climatic zones, Regions, Foreign countries, Ecological distribution, Tropic, Subtropic, Environmental gradient, *Transkei(Africa).

This survey was conducted to provide information to the Transkeian Government relative to its concern of rational conservation/utilization of its coastal areas. Mngazana supports the richest estuarine fauna and flora known in Transkei and some of the best developed mangroves in southern Africa. Invertebrate fauna includes temperate, tropical, and subtropical species. Compared to the fauna of soft substrates, that of rocks has a higher percentage of stenohaline and estuarine forms, and a more restricted distribution. A high percentage of the biomass of invertebrates in soft substrates consists of detritivores, and the biomass is related to the organic content of the substrate. Physical factors, dissolved oxygen, water transparency, salinity, nitrate, nitrite, silicate, total phosphorus, substrate particle size, and percent organic material in the substrate were determined. Nine sampling stations were used. Mangrove mud has the highest organic content and supports the highest biomass, but few species can tolerate the conditions there. Mangroves are probably the major primary producers in the system. Mngazana's features makes its conservation of unquestionably high importance. (Zielinski-IPA)
W81-01744

A MATHEMATICAL MODEL OF THE KOKSOAK RIVER. (MODELE MATHEMATIQUE DE LA RIVIERE KOKSOAK),
Laval Univ. (Quebec). Dept. of Civil Engineering.
Y. Quellet, and Y. Ropars.
Canadian Journal of Civil Engineering, Vol 7, No 3, p 477-491, September, 1980. 16 Fig, 16 Ref. (English Summary).

Descriptors: *Estuaries, *Model studies, *Salinity, Tides, Rivers, Mathematical models, Koksoak River(Canada), Kuuijjuaq River(Canada), *Canada.

An unidimensional mathematical model using the finite differences method has been developed to study the effects on tides and salinity distribution of a reduction of freshwater discharge in an estuary, the Koksoak River, flowing into Ungava Bay, Canada. Although data were not complete or precise enough to make definite conclusions, some general trends were observed in the comparison between simulated canals and the river itself. (Cassar-FRC)
W81-01781

INFLUENCE OF BIOLOGICAL AND PHYSICAL PROCESSES ON DISSOLVED OXYGEN DYNAMICS IN AN ESTUARINE SYSTEM: IMPLICATIONS FOR MEASUREMENT OF COMMUNITY METABOLISM,
Maryland Univ., Cambridge. Center for Estuarine and Environmental Studies.
W. M. Kemp, and W. R. Boynton.
Estuarine and Coastal Marine Science, Vol 11, No 4, p 407-431, October, 1980. 5 Fig, 4 Tab, 73 Ref.

Descriptors: *Dissolved oxygen, *Aquatic ecosystems, *Estuaries, Respiration, Advection, Photosynthesis, *Chesapeake Bay, Biological communities, Diel migration, Diffusion, Fluctuations, Abiotic environment, Diurnal, Nutrients.

The dynamics of dissolved oxygen (DO) were studied in the estuarine ecosystem near Calvert Cliffs, Chesapeake Bay. Community photosynthesis and respiration rates were calculated in several areas of the bay from time course fluctuations of DO in the open water and in bottles and benthic chambers. Measurements of oxygen diffusion across the air/water interface and of the DO levels in the vertical plane of the water column were performed. Horizontal net dispersion of oxygen was measured as the difference. About 50% of the total oxygen flux at deeper stations is due to biological factors, and 50% to physical processes. Mean values of community photosynthesis accounted for 50% of the total inputs to the supply of DO, while community respiration made up 43% of the outflows. Atmospheric gas transfer contributed about 8% of the inputs and 3% of the outputs. Horizontal dispersion was responsible for about 40-50% of the DO changes in either direction. Differences in photosynthesis and respiration between open and closed systems were found on 11 of 16 occasions and were probably due to artificial decoupling of the experimental environment from major routes of nutrient flux. Open water estimates provided more realistic DO patterns. Some specifications are offered for aquatic environments to be used in open-water methods. (Geiger-FRC)
W81-01863

COMPARISON OF METHODS FOR ANALYSIS OF THE TRANSVERSE AND VERTICAL CIRCULATION CONTRIBUTIONS TO THE LONGITUDINAL ADVECTIVE SALT FLUX IN ESTUARIES,
Washington Univ., Seattle. Dept. of Oceanography.
M. Rattray, Jr., and J. G. Dworski.
Estuarine and Coastal Marine Science, Vol 11, No 5, p 515-536, November, 1980. 3 Fig, 6 Tab, 16 Ref.

Descriptors: *Model studies, *Estuaries, *Fluctuations, *Salinity, Mathematical studies, Velocity, Sampling, Water analysis, Circulation, Advection, Movement, Stratification, Profiles, Cross-sections, Gravity.

Three different sampling patterns were used to assess the transverse and vertical variations of parameters in an estuary cross-section. The sampling designs, which were based on the manner in which the total cross-section is broken up into sub-areas, were made up of uniform vertical spacing and proportional transverse spacing in Design I, proportional vertical spacing and uniform horizontal spacing in Design II, and uniform vertical spacing and uniform horizontal spacing in Design III. Three different hypotheses concerning the nature of the distribution were applied mathematically to test the designs. The model was applied to the Southampton Water, an estuary where both the salinity and velocity have important transverse and vertical variations. At Southampton Water, the longitudinal advective salt flux was found to be almost entirely due to the vertical variations in salinity and velocity. These findings were contrary to previous studies, and followed from the effect of gravity on the vertical stratification of both the salinity and velocity distributions. (Geiger-FRC)
W81-01864

SEASONAL VARIATION IN SPECIES COMPOSITION OF RECENTLY SETTLED FOULING COMMUNITIES ALONG AN ENVIRONMENTAL GRADIENT IN THE INDIAN RIVER LAGOON, FLORIDA,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
D. Mook.
Estuarine and Coastal Marine Science, Vol 11, No 5, p 573-581, November, 1980. 4 Fig, 2 Tab, 29 Ref.

Descriptors: *Fouling organisms, *Aquatic animals, *Environmental gradient, Seasonal, *Lagoons, Invertebrates, Mollusks, *Indian River Lagoon(FL), Florida, Crustaceans, Annelids, Distribution patterns.

Fouling organisms were monitored monthly for a year in the Indian River Inlet, Florida, near the Fort Pierce Inlet, where salinity and temperature are relatively constant, and at points on a gradient approaching Vero Beach 16 km distant, where these parameters are more variable. The number of species was highest near the inlet and gradually decreased toward Vero Beach. Near the inlet, colonial species were dominant; further away from the inlet, eurytopic solitary forms prevailed. It is believed that the colonial species are better competitors for available space. (Cassar-FRC)
W81-01870

WAVE INFLUENCES ON RIVER-MOUTH DEPOSITIONAL PROCESS: EXAMPLES FROM AUSTRALIA AND PAPUA NEW GUINEA,
Sydney Univ. (Australia). Dept. of Geography.
L. D. Wright, B. G. Thom, and R. J. Higgins.
Estuarine and Coastal Marine Science, Vol 11, No 3, p 263-277, September, 1980. 8 Fig, 24 Ref.

Descriptors: *Waves(Water), *Sediment transport, *Rivers, Deposition(Sediments), Deltas, Fluvial sediments, *Estuaries, Ocean waves, Surf, Currents(Water), Sand bars, Sedimentary structures, Rip currents, Littoral drift, Turbulence, Tidal effects, Sediment distribution, Sedimentation, Running waters, *Jaba River(New Guinea), Papua(New Guinea), *Shoalhaven River(Australia), Shoals, River flow, Coasts, Australia, New Guinea.

Patterns of sediment transport and deposition were observed at the river-sea interface of the Shoalhaven River, eastern Australian coast, and the Jaba River, Papua New Guinea. Although dissimilar in some ways, both river mouths are strongly influenced by wave processes. The generalities shared by both deltas, which can be attributed to wave action, are as follows: (1) the force of the breaking waves causes abrupt deceleration and lateral spreading of river water, resulting in a broad crescent-shaped bar within 2 channel widths seaward of the outlet, (2) turbid river water remains trapped on either side of the river mouth, (3) broad shoals capped by shoreward migrating swash bars are produced by wave reworking and steep lateral effluent velocity gradients, (4) sand is returned toward the shore, constricting the outlet, which is partially counteracted by friction between effluent and bar, (5) water flows away from the place of maximum deposition, then toward the sea in large-scale rips, which create delta-margin erosion and crescent-shaped embayments flanking the river mouth bulge, (6) estuarine conditions prevail under low and normal river stages, and wave activity helps flood tides transport sands upstream. These characteristics of wave-dominated river mouths are different from those of river mouths dominated by tides or the river flow. (Cassar-FRC)
W81-01872

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DEVELOPMENT OF HOLLOW FIBER REVERSE OSMOSIS MEMBRANES,
Albany International Research Co., Dedham, MA.
D. K. Schiffer, C. E. Kramer, R. B. Davis, and M. J. Coplan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-167215, Price codes: A03 in paper copy, A01 in microfiche. Final Report prepared for Office of Water Research and Technology, November, 1980. 32 p, 11 Fig, 7 Tab. OWRT-C-90266-D(No 9531)(1), 14-34-0001-9531.

Descriptors: *Reverse osmosis, *Composite membranes, *Membrane processes, *Desalination processes, Membranes, Semipermeable membranes, Desalination apparatus, Thin films.

Work conducted under this contract is a continuation of the development of a hollow fiber reverse osmosis composite membrane. Five systems (sulfonated polysulfone, piperazine phthalamide, immobilized zirconium, chemically bound tannins, and direct membrane formation) were investigated as replacements for the polyfuran membrane developed during contract 14-34-0001-7551. Sulfonated polysulfone was the most promising and enough membranes were prepared for testing in small module form at OWRT-Roswell. Testing indicates that SPS is a stable membrane with tolerance to

aggressive feeds, such as 50C seawater and pH 8, 100 ppm active chlorine.
W81-01652

SPARGED AIR DISTILLED WATER RECOVERY SYSTEM,
W. A. Rhodes.
U.S. Patent No 4,200,497, 5 p, 2 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 993, No 5, p 1737, April 29, 1980.

Descriptors: *Patents, *Desalination, *Desalination apparatus, Separation techniques, Water purification, Distillation, Condensation, Desalination processes, Bubbles, Jets.

The invention relates to the distillation of water for purification purposes such as desalination and is concerned primarily with such a system in which sparged air is introduced into a body of water close to the surface where it generates bubbles which pass to the surface of the water and entrain vapor to form a mixture of air and water vapor which is conducted to a condenser from which distilled water is drained. The sparged air distilled water recovery system comprises a closed tank having spaced end walls. Passing through one end wall is a conduit that is connected at one end to a source of supply of water under pressure and terminating in a jet nozzle. An overflow drain is mounted in the opposite end wall and maintains substantially constant the level of water in the tank. A closed vapor and air circulating system extends from the end wall having the overflow drain to the end wall in which the jet nozzle is mounted. (Sinha-OEIS)
W81-01712

ION EXCHANGE PROCESS FOR DESALINATION,
Rohm and Haas Co., Philadelphia, PA. (Assignee).
H. Shimizu.
U.S. Patent No 4,202,737, 12 p, 4 Fig, 1 Tab, 5 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 616, May 13, 1980.

Descriptors: *Patents, *Water treatment, *Desalination, Desalination processes, Desalination apparatus, Ion exchange, Resins, Carbonates, *Heat regeneration.

An ion exchange process for desalination is described. A thermally regenerable ion exchange resin having weakly acidic free acid groups and weakly basic free base groups is carbonated, for example by contact with an H2CO3 solution, whereby the free base groups are converted to a carbonate form. The conversion may be effected either prior to or simultaneously with contact between the resin and the solution to be desalinated. Both fixed bed and continuous or semi-continuous resin systems are usable. The process maintains the desalination capacity at a high level while providing effective desalination. (Sinha-OEIS)
W81-01731

DEVELOPMENT OF IMPROVED CLEANING AND SURFACE REGNERATION METHODS AND ECONOMIC ANALYSIS OF THESE METHODS FOR SEAWATER MEMBRANES.
Burns and Roe Industrial Services Corp., Oradell, NJ.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170607, Price codes: A06 in paper copy, A01 in microfiche. Report prepared for Office of Water Research and Technology, January 31, 1981. 104 p, 12 Fig, 14 Tab, 21 Ref, 3 Append. OWRT-C-90183-D(No 9524)(1), 14-34-0001-9524.

Descriptors: *Desalination, *Membrane processes, *Reverse osmosis, Seawater, Thin film composite membranes, Hollow fiber nylon membranes, Membrane regeneration.

Seawater membranes having deteriorated salt rejection through partial loss of the desalting layer are regenerated to approach their initial rejection through the application of chemical agents. The agents include water dispersible resins, surfactants, other colloids and organic acids. The effectiveness of a regenerating agent is a function of (1) type of membrane material; (2) initial level of salt rejection, and (3) flow conditions. At optimum additive concentration, the membrane quality parameter, A super 2/B increases. For an agent to sustain its effect for a long period, it should be capable of some specific interaction with the membrane such as hydrogen bonding. In all cases studied, it is cost effective to clean and regenerate rather than replace modules. However, in some cases, replacement is recommended.
W81-01757

DATA COLLECTION AND ANALYSIS OF COMMERCIAL MEMBRANE DESALINATION PLANTS--VOLUME I--SUMMARY,
DSS Engineers, Inc., Fort Lauderdale, FL.
S. Latour, J. Anderton, and J. Menningmann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170573, Price codes: A06 in paper copy, A01 in microfiche. Final Report to the Office of Water Research and Technology, Sept., 1980. 100 p, 15 Fig, 34 Tab. OWRT-C-80130-S(No 8531)(1), 14-34-0001-8531.

Descriptors: *Desalination, *Plant histories, *Electrodialysis, *Reverse osmosis, *Membrane processes, Hollow fibers, Composite R.O. membranes, Cellulose acetate membranes, Brackish water desalting, Operating costs, Raw water pretreatment.

This report is compiled in three volumes: I. Summary, II. Reverse Osmosis Plants; III. Electrodialysis/Electrodialysis Reversal Plants. Twenty-four commerical membrane desalination plants, ranging in size from 12,000 GPD to 5.0 MGD were surveyed including 14 reverse osmosis, 6 electrodialysis-reversal, and 4 standard electrodialysis facilites. Background information is presented on each plant's history and future plans; regarding water demand, feedwater supply, treatment options, and initial procurement. The design of each plant is documented with a piping and instrumentation diagram and an accompanying description of the initial and existing design as regards the feedwater supply, pretreatment, demineralization process, product/brine treatment, and the instrumentation and controls. An in-depth analysis of individual plant's operations and performance addresses major material failures, operating efficiences, and the membrane cleaning systems employed. Normalized production costs are developed from the stated consumption of the consumables used. Operator training and requirements are explained for each of the plants. Recommendations for more efficient operations are also offered.
W81-01758

DATA COLLECTION AND ANALYSIS OF COMMERCIAL MEMBRANE DESALINATION PLANTS--VOLUME II--REVERSE OSMOSIS PLANTS,
DSS Engineers, Inc., Fort Lauderdale, FL.
S. Latour, J. Anderton, and J. Menningmann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170581, Price codes: A15 in paper copy, A01 in microfiche. Final Report to the Office of Water Research and Technology, Sept., 1980. 310 p, 118 Fig, 67 Tab. OWRT-C-80130-S(No 8531)(2), 14-34-0001-8531.

Descriptors: *Desalination, *Plant histories, *Reverse osmosis, *Membrane processes, Hollow fibers, Composite R.O. membranes, Cellulose acetate R.O. membranes, Brackish water desalting, Operating costs, Raw water pretreatment.

This report is compiled in three volumes: I. Summary, II. Reverse Osmosis Plants; III. Electrodialysis/Electrodialysis Reversal Plants. Twenty-four commerical membrane desalination plants, ranging in size from 12,000 GPD to 5.0 MGD were surveyed including 14 reverse osmosis, 6 electrodialysis-reversal, and 4 standard electrodialysis facilities. Background information is presented on each plant's history and future plans; regarding water demand, feedwater supply, treatment options, and initial procurement. The design of each plant is documented with a piping and instrumentation diagram and an accompanying description of the initial and existing design as regards the feedwater supply, pretreatment, demineralization process, product/brine treatment, and the instrumentation and controls. An in-depth analysis of individual plant's operation and performance addresses major material failures, operating efficiencies, and the membrane cleaning systems employed. Normalized production costs are developed from the stated consumption of the consumables used. Operator training and requirements are explained for each of the plants. Recommendations for more efficient operations are also offered.
W81-01759

DATA COLLECTION AND ANALYSIS OF COMMERCIAL MEMBRANE DESALINATION PLANTS--VOLUME III--ELECTRODIALYSIS/ ELECTRODIALYSIS REVERSAL PLANTS,
DSS Engineers, Inc., Fort Lauderdale, FL.
S. Latour, J. Anderton, and J. Menningmann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170599, Price codes: A12 in paper copy, A01 in microfiche. Final Report to the Office of Water Research and Technology, Sept., 1980. 245 p, 48 Tab, 91 Fig. OWRT-C-80130-S(No 8531)(3), 14-34-0001-8531.

Descriptors: *Desalination, *Plant histories, *Electrodialysis, *Membrane processes, *Ion exchange membranes, Brackish water desalting, Operating costs, Raw water pretreatment.

This report is compiled in three volumes: I. Summary, II. Reverse Osmosis Plants; III. Electrodialysis/Electrodialysis Reversal Plants. Twenty-four commercial membrane desalination plants, ranging in size from 12,000 GPD to 5.0 MGD were surveyed including 14 reverse osmosis, 6 electrodialysis-reversal, and 4 standard electrodialysis facilities. Background information is presented on each plant's history and future plans; regarding water demand, feedwater supply, treatment options, and initial procurement. The design of each plant is documented with a piping and instrumentation diagram and an accompanying description of the initial and existing design as regards the feedwater supply, pretreatment, demineralization process, product/brine treatment, and the instrumentation and controls. An in-depth analysis of individual plant's operations and performance addresses major material failures, operating efficiencies, and the membrane cleaning systems employed. Normalized production costs are developed from the stated consumption of the consumables used. Operator training and requirements are explained for each of the plants. Recommendations for more efficient operations are also offered.
W81-01760

3C. Use Of Water Of Impaired Quality

AQUACULTURE IN SOUTH EAST ASIA: SOME POINTS OF EMPHASIS,
Tamil Nadu Agricultural Univ., Tuticorin (India). Fisheries Coll.
M. N. Kutty.
Aquaculture, Vol 20, No 3, p 159-168, July, 1980. 1 Fig, 1 Tab, 33 Ref.

Descriptors: *Fish farming, *Recycling, *Waste disposal, Eutrophication, Nutrients, Commercial fishing, *Aquiculture, Sewage, Carp, Salmonids, Commercial shellfish, Asia, Food abundance, *India.

Some aspects of aquiculture in Asia are reviewed, with emphasis on the need for increased production of cheaper animal protein. The Eastern cultures have generally been more advanced in the commercial growing of aquatic species. Aquiculture is practiced in developing countries mainly to provide organisms to serve as food and to recycle organic wastes. The priorites of current aquiculture programs, which are supported by many international organizations, are discussed. The use of sewage as a nutrient source in fish culture systems has been practiced in several Asian countries. Controlled eutrophication has given high production rates with caged fish in Indonesian streams, and the

polyculture of carp has been tested in sewage-fed ponds in India. Fish raised on sewage must be examined thoroughly for pathogens before they are deemed fit for human consumption. Semi-cultural conditions of fish growing using oceans and man-made reservoirs may also be profitable. The abiotic factors affecting fish reproduction and growth must be carefully controlled. Behavioral patterns of fish should also be studied to optimize fish growth and prevent wasting of energy derived from food. Other areas of aquiculture that require further research are the genetic improvement of species used for breeding and fish food sources. (Geiger-FRC)
W81-01767

CHIRONOMID FARMING-A MEANS OF RECYCLING FARM MANURE AND POTENTIALLY REDUCING WATER POLLUTION IN HONG KONG,
Chinese Univ. of Hong Kong, Shatin. Dept. of Biology.
For primary bibliographic entry see Field 5G.
W81-01776

LONG-TERM EFFECTS OF IRRIGATION WITH WASTE WATER,
Utah Water Research Lab., Logan.
J. H. Reynolds, M. O. Braun, W. F. Campbell, R. W. Miller, and L. R. Anderson.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 672-687, April, 1980. 5 Fig, 12 Tab, 21 Ref.

Descriptors: *Irrigation water, *Irrigation effects, *Waste water irrigation, Effluents, Irrigation, Alfalfa, Municipal wastes, Coliforms, Heavy metals, On-site investigations, Phosphorus, Soil disposal fields, *Impaired water use.

A 24-month study to determine the long-term effects of applying secondary treated municipal effluent to land is reviewed. Data collected at a site irrigated with waste water effluent since 1957 was compared with data collected at a normal irrigation site. The waste water irrigation site was part of a slow-rate or crop-irrigation land application system. Parameters monitored on a monthly basis included: total coliforms, fecal coliforms, fecal streptococcus, various chemical properties, levels of various metals including heavy metals, and various organic compounds. Soil characteristics and plant characteristics were determined. The secondary treated municipal effluent was of significantly poorer quality than the normal irrigation water, but it was acceptable for crop irrigation. The treated site showed no accumulation of nitrogen, lead, copper, zinc, chromium, or cadmium. There was an increase in available phosphorus at the treated site, but there was no harmful accumulation of heavy metals in alfalfa grown there. There seemed to be no serious harmful effects as a result of long-term irrigation with waste water. (Small-FRC)
W81-01823

WATER REUSE: AN UNFINISHED AGENDA,
C. C. Johnson Associates, Silver Spring, MD.
C. C. Johnson, Jr.
Environmental Science & Technology, Vol 14, No 11, p 1304-1306, November, 1980.

Descriptors: *Water reuse, *Conferences, Groundwater recharge, Public health, Virginia, Water quality, Reclamation, Recharge, Reclaimed water, Potable water, Water purification, Infiltration.

An EPA Symposium on Protocol Development was held in Virginia, July 29-31, 1980 to develop criteria and standards for potable water reuse and non-potable options. The meeting sought to recommend basic principles that could be used in the decision-making process and specify experiments which could be used to help answer the questions that still exist concerning potable water reuse. The symposium was attended by toxicologists, engineers, chemists, groundwater specialists, microbiologists and researchers in the field of non-potable options. Key issues centered around the reuse of water due to shortages in potable supplies and the need for overall protection of public health. Deliberations among the workshop members focussed on formal charges to consider the source of the water, its quality, treatment alternatives, and monitoring needs. Water reuse programs are currently in operation in many foreign nations and on an experimental basis in Virginia. Groundwater recharge programs are essentially water reuse programs. Unplanned reuse occurs when treatment plant intakes exist just downstream of waste water treatment plant discharge sites. Most of the symposium working groups agreed that the problems of potable reuse were not insurmountable, and it could be achieved with updated technology. It was also concluded that more research was needed on the transport of pathogens, metals, and organics in groundwater recharge and other water reuse systems. (Geiger-FRC)
W81-01898

3D. Conservation In Domestic and Municipal Use

REPORT ON WATER LOSSES,
For primary bibliographic entry see Field 5F.
W81-01773

3E. Conservation In Industry

BACKWASH WATER RECYCLING SYSTEM,
PepsiCo., Inc., Purchase, NY. (Assignee).
H. C. De Longe, and W. S. Fabian.
U.S. Patent No 4,202,768, 6 p, 1 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 625, May 13, 1980.

Descriptors: *Patents, *Water treatment, *Industrial water, *Water reuse, Filtration, Water quality control, Recycling, *Backwashing, Holding tanks.

A process and apparatus for the treatment of the aqueous backwash effluent resulting from a backwashing operation of an industrial filter are described. During the backwashing operation, particulate matter and solids are dislodged from the industrial filter so as to be entrained in the backwash effluent, and the effluent is passed through a backwash filter to remove these materials. After passing through the backwash filter, the normally water-based backwash solution is directed to a holding tank for storage until a subsequent backwashing operation is required. The pH value and chlorination level of the backwash solution are periodically adjusted to maintain them within selected ranges in order to optimize the sanitizing effect of the solution during the backwashing operation. The process and apparatus results in the consumption of a much smaller quantity of water than prior arrangements wherein a single use backwash solution is dumped into the general effluent discharge of the plant. (Sinha-OEIS)
W81-01736

3F. Conservation In Agriculture

SELF-PROPELLED IRRIGATION SYSTEM,
E. Stenild.
U.S. Patent No 4,201,343, 6 p, 3 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 994, No 1, p 146, May 6, 1980.

Descriptors: *Patents, *Irrigation systems, Sprinkler irrigation, *Application equipment, Mechanical equipment, Irrigation operation and maintenance, Irrigation efficiency.

A self-propelled irrigator has a water-driven rotor carrying spray nozzles and a reel driven by the rotor for winding up a rope for moving the irrigator over the ground. The reel is driven by a transmission including a ratchet wheel, the teeth of which are successively hit by an impact member on the rotor. The rotor functions as an energy-accumulating flywheel, and every time the stop member hits a tooth on the ratchet wheel, some of the accumulated rotatory energy is supplied to the power transmission, which drives the reel upon which the rope is wound. Since the free end of the rope is secured to a fixed point, the irrigator is with great force pulled smoothly forward, thereby ensuring uniform irrigation. (Sinha-OEIS)
W81-01720

SHIFTABLE STATOR SPRINKLER HEAD,
Toro Co., Riverside, CA. (Assignee).
L. J. Lichte.
U.S. Patent No 4,201,344, 8 p, 8 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 994, No 1, p 146, May 6, 1980.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Application equipment, Nozzles, Irrigation operation and maintenance, Irrigation efficiency.

A reversible turbine-driven sprinkler head includes a vaned turbine motor for rotatably driving a nozzle. The turbine is unresponsive to the normal flow of fluid through the sprinkler head to the nozzle. Switchable deflection means are included for deflecting the flow of fluid through the body against the turbine to cause rotation in either of two directions. By deflecting the fluid flow to cause the turbine to rotate in one direction, the nozzle is rotated in one direction. By switching the direction of fluid deflection to cause the turbine to flow in the opposite direction, the nozzle is rotated in the opposite direction. Adjustable means are provided for setting the positions relative to the rotation of the nozzle whereas the deflection of the fluid flow is reversed, whereby the nozzle is caused to repeatably oscillate between a first and a second position. (Sinha-OEIS)
W81-01721

CENTER PIVOT IRRIGATION SYSTEM WITH SLINGER-TYPE SPRINKLER MEANS,
L. F. Knudsen.
U.S. Patent No 4,202,596, 6 p, 7 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 572, May 13, 1980.

Descriptors: *Patents, *Irrigation systems, *Sprinkler irrigation, Application equipment, Irrigation efficiency, Irrigation operation and maintenance.

A mobile irrigation system includes an elongated horizontal water conduit assembly having spaced support structures. One end of the water conduit assembly is connected with a source of water under low pressure and discharge pipes are supported from the assembly at spaced points. They open upwardly and outwardly from the interior of the conduit assembly. Motor driven generally horizontal and centrally apertured discs are journaled from the assembly and the discharge pipes project upwardly through the central apertures in the discs. The upper end portions of the discharge pipes include generally horizontal outwardly opening outlet portions for discharging low pressure water. The disc includes upstanding water slinger vanes spaced from each other for engaging and angularly accelerating the water discharged onto the discs upon rotation of the latter. The outer ends of the vanes are contoured to discharge the accelerated water at high velocity. (Sinha-OEIS)
W81-01729

IRRIGATION-HYDROMETRY (BESPROEIING - WATERMETING),
Department of Agricultural Technical Services, Pretoria (South Africa).
J. W. Badenhorst.
The Citrus and Subtropical Fruit Journal (Johannesburg), No 548, p 6-11, 14-15, 24, July, 1979. 12 Fig, 10 Tab, 4 Ref.

Descriptors: *Flow measurement, *Flow system, *Flowmeters, *Hydrometry, *Irrigation practices, *Agriculture, Instrumentation, Accuracy, Flow rates, Flow characteristics, Flow discharge(Water), Gages, Instrumentation, Orifice flow, Pipe flow, Hydraulics, Measurement, Water properties, Design criteria, Irrigation efficiency, Streamflow, Analysis, Irrigation, Benefits.

Measurement of water flow in irrigation practice is reviewed. Attention is given to the simplest and most inexpensive methods that can be used for the accurate determination of flow rate of water as applied in agriculture. Covered are gravimetric and volumetric methods, the measurement of flow rates in vertical and horizontal pipes, the siphon pipe method, commerically-available hydrometers, and the orifice plate method. Design criteria are provided for the various hydrometry methods, along with seven practical examples (and their solutions) to illustrate the use of the conversion tables provided. (Zielinski-IPA)
W81-01746

SUCCESSFUL MICRO-IRRIGATION IN ZULULAND,
Llanwarne Estates, Zululand (South Africa).
W. Koekemoer.
The Citrus and Subtropical Fruit Journal (Johannesburg), No 549, p 14-15, August, 1979.

Descriptors: *Irrigation practices, *Irrigation efficiency, *Africa, *Irrigation effects, Irrigation design, Crop response, Crop production, Infiltration, Irrigation, Watering, Effects, Farm management, Trees, Fruit crops, Orchards, Plant groupings, Profit, Costs, Economic efficiency, Benefits, Cultivation, Cultivated lands, Mechanical control, Planting management, *Zululand(Africa).

Micro-irrigation is considered an instrument to ensure maximum profit in the cultivation of trees. The first system was installed in 1974. Nineteen advantages of this system (micro-irrigation) over conventional methods of irrigation (flood irrigation and dragline) have been enumerated and discussed. Water and labor savings are made, new plantings come into production sooner, and larger production (easily, 10%) is noted. The method extends tree life (over-irrigation causes root-rot), diminishes appearance of creasing, burst fruit and thick skins, and has low maintenance costs (no moveable parts; uses buried pipes). Other advantages include: erosion prevention; performance of other orchard activities (spraying, fertilizing, picking) during micro-irrigation; facilitated weed control (only the section under the tree gets water); independent of soil structure or ground grade; even blooming; and provides convenient locations of filling points for spray application. Also, fertilizers can be applied through micro-irrigation and windbreaks can be supplied with water from microjets at no real extra cost. Since the tree is supplied with sufficient water continuously, its metabolic process function is undisturbed. (Zielinski-IPA)
W81-01747

SPRING SOIL WATER, PRECIPITATION, AND NITROGEN FERTILIZER: EFFECT ON BARLEY YIELD,
Department of Agriculture, Lethbridge (Alberta). Research Station.
J. B. Bole, and U. J. Pittman.
Canadian Journal of Soil Science, Vol 60, No 3, p 461-469, August, 1980. 2 Fig, 3 Tab, 17 Ref.

Descriptors: *Soil water, *Precipitation, *Nitrogen fertilizer, *Yield equations, *Barley, Crop production, Fertilizers, Rainfall, Model studies, On-site investigations, Irrigation, Mathematical studies, Nitrogen compounds, Water conservation.

A regression model (R=0.94) based on results of a 5-year field study was used to describe barley yield as a function of available soil water in the spring (WS), growing season precipitation (GSP), and N fertilizer. The study was undertaken to synchronize fertilization with optimum soil water conditions in order to minimize the use of irrigation water later on in the growing season. Barley yields on plots with WS and GSP levels within the scope of the data used to derive the equation were similar to yields predicted by the model. WS was based on soil water measured on May 15 or June 1, and GSP was measured for the period extending from June 1 to July 31. When rainfall occurring after July 31 was included in the data, the accuracy of the model sharply decreased. GSP and WS had a similar effect on yield at the GSP levels occurring in the study. However, when the long-term average GSP and WS levels recorded at Lethbridge were used, WS was only about half as effective as GSP on stubble, and one-third as effective on summer fallow. GSP was three times more effective on barley response to N fertilizer than WS. A farmer may use the model to determine optimum rates of N fertilization based on a gravimetrically determined WS level at seeding, with the GSP probability representing risk levels when the current cost: price ratio for N fertilizer and barley are known. (Geiger-FRC)
W81-01783

SPRING SOIL WATER, PRECIPITATION, AND NITROGEN FERTILIZER: EFFECT OF BARLEY GRAIN PROTEIN CONTENT AND NITROGEN YIELD,
Department of Agriculture, Lethbridge (Alberta). Research Station.
J. B. Bole, and U. J. Pittman.
Canadian Journal of Soil Science, Vol 60, No 3, p 471-477, August, 1980. 2 Fig, 2 Tab, 17 Ref.

Descriptors: *Soil water, *Yield equations, *Proteins, Precipitation, *Barley, *Nitrogen yield, Fertilizers, Nitrogen compounds, Irrigation, Mathematical studies, Crop production, Rainfall, Water conservation, Model studies, On-site investigations, Absorption, Nitrogen.

Cereal protein levels are affected by N fertilization and the amount of available moisture. A five year study was undertaken to derive a mathematical expression relating barley protein content and N uptake to stored soil water and precipitation, and to optimize fertilization and planting time to conserve the amount of irrigation water required later on in the growing season. Barley protein content and yield were mathematically described as a function of available soil water before seeding (Ws), growing season precipitation (GSP), and fertilizer N level (N). Ws values were calculated from data derived from fall irrigation practices and from fields prepared by covering plots with polyvinyl chloride sheets to exclude fall and winter precipitation and snowmelts. N rates increased protein content greatly when Ws was low. With 100-180 kilograms N/ha and Ws values of less than 100 mm, protein contents of 15-19% were achieved. If Ws was over 150 mm, then N rates greater than 100 kilograms/ha could be used. When Ws was less than 100 mm, protein content could only be maintained below the maximum level for malting barley by restricting N rates to 20-50 kilograms/ha. Protein content was not affected by GSP levels in this study. Although barley grain N yield ranged from negligible levels to over 100 kilograms/ha, in general the incremental N yield was less than 30% of the rate of N applied during fertilization. (Geiger-FRC)
W81-01784

WATER-USE EFFICIENCY OF TRANSPLANTED AND DIRECT-SOWN RICE UNDER DIFFERENT WATER-MANAGEMENT PRACTICES,
Indian Agricultural Research Inst., New Delhi.
S. B. Hukkeri, and A. K. Sharma.
Indian Journal of Agricultural Sciences, Vol 50, No 3, p 240-243, March, 1980.

Descriptors: *Rice, *Rice transplanting, *Irrigation efficiency, Water management, Irrigation practices, Submergence, Planting management, Water resources, Efficiency, *India, Cereal crops.

Rice was grown on sandy clay loam soils at Delhi, India, during the wet seasons of 1972 and 1973. Transplanting was the most water-efficient method of the 5 planting treatments tried. It produced the largest crop and used less water, 183 cm per year, than the 4 direct sowing methods, 219 to 234 cm per year. Three water management methods were tried. Submergence for almost the entire growth season using 262 cm of water yielded the best crop, but required the most water. The other two methods produced almost as much grain but with greatly reduced water use. The method using intermittent submergence only during critical stages of tillering and flowering used 164 cm of water. The most water efficient practice combined transplanting with minimum submergence. A good alternative method for areas and seasons with ample water resources was the direct seeding with sprouted seeds on puddled soil. (Cassar-FRC)
W81-01867

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

URBAN RUNOFF MANAGEMENT STRATEGIES,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4C.
W81-01658

AQUATIC WEED CUTTER, DE-ROOTER AND HARVESTER,
E. G. Stewart.
U.S. Patent No 4,202,155, 12 p, 6 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 418, May 13, 1980.

Descriptors: *Patents, *Aquatic weeds, *Aquatic weed control, Channel improvement, Equipment, Weed cutters.

An apparatus for cutting, de-rooting and harvesting of aquatic weed growth is disclosed. The apparatus is of modular construction for ease of land transportation and includes a cutting and de-rooting head assembly which is carried by extensible framing for proper positioning on the bed of a river or lake. The head assembly has weed severing means and scribbing, polishing means in the form of vortex generators and may include lake bed scarifying means to assist in de-rooting weed growth. Cut weeds and weed fragments are contained in a vertically extensible curtain containment chamber from which they are loaded into a trailing hopper. The problems of turbidity, cut weed collection and fragment containment are overcome by providing a retractible containment curtain which envelops the working head and frame extender assemblies and leads the cut weeds and fragments to a collecting beltless conveyor and a spill-over fragment trap. (Sinha-OEIS)
W81-01728

INVESTIGATIONS OF SMALL, MAN-MADE IMPOUNDMENTS ON THE HYDROLOGY OF THE LOWER OAK CREEK DRAINAGE AREA, COCONINO AND YAVAPAI COUNTIES, ARIZONA,
Northern Arizona Univ., Flagstaff. Dept. of Geology.
L. D. Agenbroad, D. M. Best, and C. C. Avery.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173775. Technical Report, January, 1981. 68 p, 7 Fig, 4 Tab, 14 Ref, 1 Append. OWRT-A-102-ARIZ(1).

Descriptors: *Drainage area, *Drainage engineering, Drainage wells, *Impoundments, *Flood protection, Floodwater, Groundwater reservoirs, Drainage, Drainage systems, Drainage basins, Drainage effects, Drainage districts, Arizona, Controlled drainage, Civil engineering, Construction equipment, Flow, Drainage density, Drainage water, *Stock water, Hydrology, Impounded waters, Flow system, Engineering structures, Groundwater recharge.

The Lower Oak Creek drainage area in north-central Arizona covers about 240 square miles, and presently contains 93 stock tanks having a potential capacity of almost 230 acre-feet. These tanks recharge the local groundwater and also serve to impede flood pulses that eventually make their way into the Salt River and thus pass through the metropolitan Phoenix area. Anomalous wet month (December-March) precipitation during 1978-1980

resulted in extensive flooding in central Arizona (especially to the south). It was concluded that stock tanks can have a definite effect on diminishing the results of such flooding by allowing for water to be retained and to be slowly seeped into the subsurface. Hence, these tanks play a significant role in the overall groundwater hydrology of the drainage area. Increased construction of such tanks and their appropriate placement in the Oak Creek watershed and surrounding drainage areas could play a key role in minimizing downstream effects of future flooding events. (Zielinski-IPA)
W81-01754

4B. Groundwater Management

DISTRIBUTION OF NITRATE IN THE UNSATURATED ZONE, HIGHLAND-EAST HIGHLANDS AREA, SAN BERNARDINO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W81-01661

POTENTIAL FOR USING THE UPPER COACHELLA VALLEY GROUND-WATER BASIN, CALIFORNIA, FOR STORAGE OF ARTIFICIALLY RECHARGED WATER,
Geological Survey, Menlo Park, CA. Water Resources Div.
M. J. Mallory, L. A. Swain, and S. J. Tyley.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $3.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-599, September, 1980. 23 p, 10 Fig, 14 Ref.

Descriptors: *Artificial recharge, *Groundwater basins, *Water storage, *California, Groundwater resources, Water table, Water quality, Water management(Applied), Evaluation, *Coachella Valley(CA), State Water Project(CA).

This report presents a preliminary evaluation of the geohydrologic factors affecting storage of water by artificial recharge in the upper Coachella Valley, Calif. The ground-water basin of the upper Coachella Valley seems to be geologically suitable for large-scale artificial recharge. A minimum of 900,000 acre-feet of water could probably be stored in the basin without raising basinwide water levels above those that existed in 1945. Preliminary tests indicate that a long-term artificial recharge rate of 5 feet per day may be feasible for spreading grounds in the basin if such factors as sediment and bacterial clogging can be controlled. The California Department of Water Resources, through the Future Water Supply Program, is investigating the use of ground-water basins for storage of State Water Project water in order to help meet maximum annual entitlements to water project contractors. (USGS)
W81-01663

GROUND WATER IN THE THOUSAND OAKS AREA, VENTURA COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. J. French.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-113235, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-63, August, 1980. 40 p, 12 Fig, 5 Tab, 14 Ref.

Descriptors: *Groundwater, *Groundwater basins, *Water management(Applied), *Urbanization, *California, Groundwater resources, Aquifers, Hydrogeology, Water wells, Water yield, Water levels, Drawdown, Groundwater movement, Water demand, Irrigation, Artificial recharge, Imported water, Water quality, Chemical analysis, Ventura County(CA), Thousand Oaks(CA), Conejo Valley(CA).

The ground-water basin beneath the city of Thousand Oaks, Calif., corresponds closely in area with the surface-water drainage basin of Conejo Valley. Before World War II there was little ground-water development. After World War II, urban development put a stress on the ground-water basin; many wells were drilled and water levels in wells were drawn down as much as 300 feet in places. Beginning in 1963, imported water replaced domestic and municipal ground-water systems, and water levels rapidly recovered to predevelopment levels or nearly so. Most of the ground water in the Thousand Oaks area is stored in fractured basalt of the middle Miocene Conejo Volcanics. Depending on the degree of occurrence of open fractures and cavities in the basalt, recoverable ground water in the upper 300 to 500 feet of aquifer is estimated to be between 400,000 and 600,000 acre-feet. The yield of water from wells in the area ranges from 17 to 1,080 gallons per minute. Most of the groundwater in the eastern part of the valley is high insulfate and has a dissolved-solids concentration greater than 1,000 milligrams per liter. In the western part of the valley the ground-water is mostly of a bicarbonate type, and the dissolved-solids concentration is less than 800 milligrams per liter. In most areas of Conejo Valley, ground-water is a viable resource for irrigation of public lands and recreation areas. (USGS)
W81-01669

HYDROLOGIC ANALYSIS OF THE PROPOSED BADGER-BEAVER CREEKS ARTIFICIAL RECHARGE PROJECT, MORGAN COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 6A.
W81-01670

DUNKIRK: AN EXAMPLE OF WATER RESOURCES OPTIMISATION. (DUNKERQUE: UN EXEMPLE D'OPTIMISATION DES RESSOURCES EN EAU),
Societe Lyonnaise des Eaux et de l'Eclairage (France).
R. Coulomb.
Aqua, No 8, p 23-26, 1980. 3 Fig, 1 Tab. (English Summary).

Descriptors: *Aquifer management, *Recharge ponds, *Groundwater recharge, *Water supply development, Surface waters, Potable water, *Dunkirk(France), Management, Planning, Public utilities, Projections, Mathematical models, Municipal water, Water consumption, Water reuse, Water resources, Water management, Optimization, France.

Sources of the Dunkirk, France, raw water supply have been diversified and expanded by installing 2 basins for recharging of surface water from the Moulle treatment plant. The recharge is programmed by mathematical model as a function of rainfall and different output flows. In addition, water is pumped from the Bourbourg Canal to the original aquifer supply. After 1990, it is planned to take surface water from a canal and store it in a 211 million gallon basin for later treatment and distribution. (Cassar-FRC)
W81-01774

4C. Effects On Water Of Man's Non-Water Activities

URBAN RUNOFF MANAGEMENT STRATEGIES,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
D. F. Kibler, and G. Aron.
Journal of the Technical Councils of ASCE, Proceedings of the American Society of Civil Engineers, Vol 106, No TC1, Proc. Paper 15600, p 1-12, Aug. 1980, 3 Fig, 4 Tab, 22 Ref. OWRT-A-049-PA(2), 14-34-0001-9040.

Descriptors: *Urban runoff, Downstream, *Hydrology, Land use, Watersheds, Abatement, Drainage, Hydrographs, Groundwater recharge, Peak discharge, Mathematical models, *Flow control, *Upstream control, *Runoff abatement, Hydraulic simulation, Hydrologic models.

A dramatic shift has occurred in the control of urban runoff over the past 10 to 15 years. The conventional practice of rapid removal and delivery of urban runoff to downstream areas is being replaced by the newer concept of reduction and detention of urban runoff in upstream source areas. A successful strategy for managing urban runoff must be based on: (1) application of proper hydrologic tools for the analysis of urban runoff under alternative land-use conditions in the watershed; (2) hydrologic and economic evaluation of the performance of alternative runoff abatement measures; and (3) projection of downstream impacts of selected abatement schemes. The purpose of this paper was to review these basic elements in urban runoff management and to comment on future directions in this evolving field.
W81-01658

OBSERVATIONS ON KINEMATIC RESPONSE IN URBAN RUNOFF MODELS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
D. F. Kibler, and G. Aron.
Water Resources Bulletin, Vol 16, No 3, p 444-452, June 1980, 12 Fig, 4 Tab, 6 Ref. OWRT-A-049-PA(3), 14-34-0001-9040.

Descriptors: *Urban runoff, *Model studies, *Storm water, *Hydrographs, Watersheds, Overland flow, Infiltration, Gages, Drainage, Synthetic hydrology, *Kinematic response, Sensitivity analysis, Parameters, Catchment, Hydraulics.

The results of sensitivity analyses conducted on various parameters of the San Francisco Stormwater Model (a version of WREM) and the Penn State Runoff Model in terms of their impact on outflow hydrographs are discussed. The parameters considered within an idealized catchment included: basin shape, impervious fraction, overland roughness and slope; detention depth; infiltration capacity; and hyetograph timing. The results for the hypothetical catchment were extended to the Izzard laboratory surfaces (asphalt, grass, roofing material) as a means of illustrating the need for changes in model structure, as opposed to continued parameter adjustment. The effects of altering the scale of hydraulic representation in the surface runoff and sewer transport calculations were demonstrated for two gaged watersheds in Hamburg, West Germany.
W81-01659

RIVER MANAGEMENT IN THE URBAN ENVIRONMENT,
R. D. Beaumont.
Imiesa (Johannesburg), Vol 4, No 6, p 25, 27, 29, June, 1979. 7 Fig.

Descriptors: *Urban runoff, *Urbanization, *Channel improvement, *Flood plains, *River flow, River regulation, Streamflow, Urban drainage, Runoff, Storm runoff, Community development, Land use, Urban mapping, City planning, Floods, Floodflow, Flow, Flood control, Floodways, Drainage systems, Watershed(Basins).

The effects of urban development on the natural stability of river systems are discussed in connection with increased runoff, channel stability, and the flood plain. Urbanization results in a greater runoff increase for smaller and more common storms than for larger and less frequent ones. In an urban environment, concreting channels and widening of channels enhance channel stability, but urbanization can also reduce groundwater and dry weather flows that adversely affect vegetal cover along river banks. Townships built close to river banks were susceptible to flooding from increased upstreams runoff, which construction would be restricted by current legislation. Legislative aspects covered (1978 Water Amendment Act requires that development plans of certain townships show the 20-year flood line, but not development constraints) and not covered (interrelation between urban upstream catchment development and

downstream flooding). The basic choice between natural/man-made channels is largely dependent on capital/maintenance costs and their benefits/constraints. (Zielinski-IPA)
W81-01748

EVALUATION OF MANGEMENT PRACTICES ON THE BIOLOGICAL AND CHEMICAL CHARACTERISTICS OF STREAMFLOW FROM FORESTED WATERSHEDS,
Pennsylvania State Univ., University Park. School of Forest Resources.
J. A. Lynch, E. S. Corbett, and W. E. Sopper.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170524, Price codes: A06 in paper copy, A01 in microfiche. Institute for Research on Land and Water Resources, Pennsylvania State University, Research Project Technical Completion Report, November, 1980, 107 p, 33 Fig, 24 Tab, 50 Ref. OWRT-A-041-PA(1), 14-34-0001-1140.

Descriptors: *Forest watersheds, *Streamflow, *Clearcutting, Herbicides, *Water quality, Vegetation, Analysis, Stress, Nutrients, Turbidity, Sediments, Aquatic life, Ecosystems, Water yield, Peak discharge, Stream gages, Watershed management, Environmental effects, Chemical characteristics, Biological characteristics, Response, Stormflow parameters.

A 106-acre oak-hickory experimental watershed in central Pennsylvania was clearcut in three phases to evaluate the effects of the clearcuts on the physical, chemical, and biological properties of streamflow. Herbicides were used to control the regrowth of vegetation so that groundwater conditions on the clearcuts would be similar for each phase analysis, and also to quantify maximum response and stress factors. The watershed response to these treatments was characterized by measuring changes in streamflow amounts and timing, stormflow parameters, streamwater temperature, nutrient concentrations, turbidity and sediment, and aquatic macroinvertebrate populations. Biologic implications for the aquatic ecosystem are presented on the basis that each aquatic organism has a particular set of environmental conditions and habitat preferences that are optimal for its maintenance.
W81-01763

4D. Watershed Protection

REVEGETATION OF MINED LAND USING WASTE WATER SLUDGE,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
W. E. Sopper, and S. N. Kerr.
Public Works, Vol 111, No 9, p 114-116, September, 1980. 2 Fig.

Descriptors: *Land reclamation, *Strip mines, *Sludge, Land management, *Revegetation, Soil erosion, Reclamation, Agricultural engineering, Spoil banks, Strip mine wastes, Coal mine wastes.

Both liquid and dewatered sludge products were obtained from local treatment plants and spread on strip mine spoil banks in efforts to reclaim the land. Dewatered sludge was applied with farm manure spreaders at a rate of 40 and 82 dry tons per acre. Immediately after sludge application and incorporation, the site was broadcast seeded with a mixture of two grasses and two legumes. The seeding mixture was Kentucky-31 tall fescue, Pennlate orchardgrass, Penngift crownvetch and Empire Birdsfoot trefoil. The two grass species will germinate quickly and provide a complete protective cover the first year, allowing time for the two legume species to become established and develop into the final vegetative cover. Results of a subsequent monitoring program demonstrated that no harmful effects had occurred as a result of applying the sludge to the ground in the land reclamation project. Even after the third year there was no apparent deterioration of the vegetative cover in any of the sludge-treated areas. Two additional examples of the use of sludge for starting vegetative covers in land reclamation efforts are noted. (Baker-FRC)
W81-01885

REVEGETATION PROJECT UTILIZES SLUDGE,
Colorado School of Mines, Golden.
B. Farquhar.
Public Works, Vol 111, No 7, p 67-68, July, 1980. 2 Fig.

Descriptors: *Land reclamation, *Mining, *Sludge, Land management, Soil erosion, Reclamation, Agricultural engineering, *Revegetation, Colorado.

The AMAX Urad Mine project in central Colorado, a land reclamation project based on the use of sludge for revegetation, is described. The Urad Molybdenum Mine is located near the foot of Berthoud Pass and US Highway 40 and was closed in 1974 after producing 48 million pounds of molybdenum concentrate and 14 million tons of ore. The problem of revegetation of the mill tailings waste product was solved by using three other waste products - rock waste from a nearby mine, waste water treatment plant sludge, and wood chips. The rock mulch provided an ideal mulch. The wood chips bound much of the nitrogen, bringing the levels down to acceptable ones for young plants. The wood also fixes the nitrogen in the humus for future plant use. The site was provided with 20 tons per acre each of sludge and wood chips, followed by an additional 10 tons of sludge per acre three years later. The use of inorganic fertilizers will maintain the vegetation permanently. The Urad reclamation project will cost between 6 and 7 million dollars when completed. (Baker-FRC)
W81-01886

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

SALMONELLA SURVIVAL IN FRESHWATER AND EXPERIMENTAL INFECTIONS IN GOLDFISH (CRASSUIS AURATUS),
Purdue Univ., Lafayette, IN. Dept. of Microbiology, Pathology and Public Health.
R. L. Lawton, and E. V. Morse.
Journal of Environmental Science and Health, Vol A15, No 4, p 339-358, 1980. 5 Tab, 16 Ref. OWRT B-076-IND(7).

Descriptors: *Salmonella, *Aerobic bacteria, *Sewage bacteria, Pollution, Fish diseases, Infection, Bottom sediments, Bacteria, Physiological ecology, *Pollutant identification.

The infection rates for various Salmonella serotypes in goldfish (Crassuis auratus) were evaluated under a number of controlled environmental conditions. Studies were undertaken to determine the number of salmonellae necessary to cause infection, and to elucidate the conditions instrumental to the continued persistence of the pathogen in the aquatic environment. All of 32 strains (representing 12 serotypes of Salmonella) studied infected goldfish. Under appropriate physiological conditions, the fish were infected for a period of two weeks with less than or equal to 5 organisms/ml water. Physiological stress to the fish augmented infection rates. Increased eutrophy, with agitation of the water, was correlated with lowered infection rates and decreased survival of the pathogen. The presence of a bottom sediment under these same eutrophic conditions resulted in infections of six weeks duration. Repeated isolation of salmonellae from the gastrointestinal tracts of the fish suggested that colonization had occurred. A cycle of reinfection, i.e. fish to water to fish, may have taken place. Thus the fish may have contributed an important element for the persistence of Salmonella in freshwater. Salmonella may be used as monitors of fecal pollution in the aquatic biosphere. These bacteria, when present in native fishes may also be retrospective indices of fecal pollution. The presence of Salmonella in any body of water raises serious questions as to water quality and safety for both man and livestock.
W81-01655

EFFECTS OF RESIDENCE IN FISHES UPON THE PATHOGENICITY OF SALMONELLA SEROTYPES FOR LABORATORY WHITE MICE,
Purdue Univ., Lafayette, IN. Dept. of Microbiology, Pathology and Public Health.
E. V. Morse, K. A. Gossett, and M. A. Duncan.
Journal of Environmental Science and Health, Vol A15, No 4, p 359-371, 1980. 4 Tab, 16 Ref. OWRT B-076-IND(6).

Descriptors: *Salmonella, *Aerobic bacteria, *Water pollution, Pathogenicity, Fish diseases, Infection, Laboratory tests, White mice, Analytical techniques, Cultures.

Increasing evidence indicates that freshwater fishes may be naturally and experimentally infected with Salmonella and may harbor the pathogen for more than 100 days. The effects upon the pathogenicity of various serotypes for white mice following residence in freshwater fishes was evaluated. Virulence patterns of serotypes cultured from fish were compared with the same serotypes cultured from man and lower animals. LD sub 50 and ID sub 50 values for the respective isolates were ascertained following intraperitoneal injection of mice. With the exception of 1 strain of S. typhimurium, var. Copenhagen (a smooth (S) phase culture, which rapidly mutated to the rough (R) state) there was no evidence of attenuation or loss of virulence of the serotypes. Results of the study indicate that residence or colonization in poikilotherms has no marked effect on pathogenicity for homoeiothermic hosts.
W81-01657

DISTRIBUTION OF NITRATE IN THE UNSATURATED ZONE, HIGHLAND-EAST HIGHLANDS AREA, SAN BERNARDINO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. M. Klein, and W. L. Bradford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-117004, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-48, September, 1980. 70 p, 20 Fig, 16 Tab, 100 Ref.

Descriptors: *Nitrates, *Groundwater, *Artificial recharge, *Aquifer management, *California, Nitrogen, Ion exchange, Irrigation effects, Water pollution sources, Water pollution control, Water quality, Chemical analysis, *San Bernardino County(CA).

In the vicinity of Highland-East Highlands, San Bernardino County, Calif., plans to recharge local aquifers with imported water would raise the water table and intercept nitrogen in the unsaturated zone. Samples from 13 test holes were analyzed to ascertain the distribution of nitrate and related inorganic nitrogen species and other water-quality characteristics. Test holes were ranked according to maximum NO3(-)-N in the top 10 feet, total NO3(-)-N in the top 10 feet, and total NO3(-)-N in the top 40 feet. In all three rankings, the top seven test holes were the same--five in or near past or present agricultural areas (primarily citrus groves), one in a feedlot, and one adjacent to an abandoned sewage-treatment plant. Two test holes in uninhabited areas ranked lowest. The control test hole ranked high in geometric mean ammonium nitrogen, suggesting that NH4(+)-N is present in freshly weathered granite. The geometric mean NH4(+)-N concentrations in six of eight test holes in citrus-related areas were significantly lower than in the control hole. High NO3(-)-N concentrations tended to be found with high specific conductance and chloride concentrations. If recharge is carried out as planned, assuming complete mixing of the recharge water and interstitial pore water in the top 20 feet of the saturated zone, NO3(-)-N concentrations in water at the top of the saturated

zone may exceed 10 milligrams per liter in seven areas studied. (USGS)
W81-01661

SULFATE REDUCTION IN GROUND WATER OF SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
W. S. Dockins, G. J. Olson, G. A. McFeters, S. C. Turbak, and R. W. Lee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-221971, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-9, February, 1980. 13 p, 3 Fig, 2 Tab, 16 Ref.

Descriptors: *Sulfur bacteria, *Groundwater, *Anaerobic bacteria, *Geochemistry, Montana, Analytical techniques, Stable isotopes, Sampling, Sites, Hydrologic data, *Southeastern Montana, Northern Powder River basin(MT), *Sulfate-reducing bacteria.

Ground waters in southeastern Montana were investigated to determine if sulfide production was bacterially mediated. Sulfate-reducing bacteria were detected in 25 of 26 groundwater samples in numbers ranging from 20 to greater than 24,000 bacteria per 100 milliliters for those samples containing bacteria. Stable sulfur isotope fractionation studies indicate a biological role in sulfate reduction. However, sulfate-reducing activity as determined by use of a radioactive sulfur isotope was observed in only 1 of 16 samples. Bacterial dissimilatory sulfate reduction is postulated to be responsible for a major part of the sulfide produced in these ground waters. These bacteria are most likely active in the adsorbed state, possibly in subsurface microzones where environmental conditions are conducive to sulfate reduction. (USGS)
W81-01662

INVESTIGATION OF ACIDITY AND OTHER WATER-QUALITY CHARACTERISTICS OF UPPER OYSTER CREEK, OCEAN COUNTY, NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-01665

WATER QUALITY OF THE NEUSE RIVER, NORTH CAROLINA--VARIABILITY, POLLUTION LOADS, AND LONG-TERM TRENDS,
Geological Survey, Raleigh, NC. Water Resources Div.
D. A. Harned.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-222896, Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-36, 1980. 88 p, 34 Fig, 15 Tab, 33 Ref.

Descriptors: *Water quality, *River basins, *Water pollution, *North Carolina, Water pollution effects, Water analysis, Regression analysis, Dissolved oxygen, Dissolved solids, Specific conductivity, Trace elements, Nutrients, Coliforms, Phytoplankton, Coastal Plains, Neuse River(NC).

A water-quality study of the Neuse River, N.C., based on data collected during 1956-77 at the U.S. Geological Survey stations at Clayton and Kinston, employs statistical trend analysis techniques that provide a framework for river quality assessment. Overall, water-quality of the Neuse River is satisfactory for most uses. At Clayton, fecal coliform bacteria and nutrient levels are high, but algae and total-organic-carbon data indicate water-quality improvement in recent years, due probably to a new wastewater treatment plant located downstream from Raleigh, N.C. Pollution was determined by subtracting estimated natural loads of constituents from measured total loads. Pollution makes up approximately 50% of the total dissolved material transported by the Neuse. Two different data transformation methods allowed trends to be identified in constituent concentrations. The methods recomputed the concentrations as if they were determined at a constant discharge over the period of record. Although little change since 1956 can be seen in most constituents, large changes in some constituents, such as increases in potassium and sulfate, indicate that the water quality of the Neuse River has noticeably deteriorated. Increases in sulfate are probably largely due to increased long-term inputs of sulfur compounds from airborne pollutants. (USGS)
W81-01668

PREDICTING SAFE CONCENTRATIONS OF VOLATILE ORGANIC SUBSTANCES IN DISCHARGES TO SEWERS,
Water Pollution Research Lab., Stevenage (England).
B. J. Borne, and J. A. Hobson.
Progress in Water Technology, Vol 12, No 3, p 77-82, 1980. 3 Tab, 1 Ref.

Descriptors: Sewage, *Vapor pressure, *Toxicity, Volatility, Laboratory tests, *Sewers, Threshold limit value, United Kingdom, *Safety factors, Working conditions.

It is necessary to relate the threshold limit value of materials in a sewer atmosphere to the concentration of volatile material in sewage. A scientific basis for predicting maximum allowable concentrations in sewage which makes use of vapor-pressure data and limiting activity coefficients is presented. Vapor pressures and limiting activity coefficients were determined in pure water for a range of volatile compounds of interest to water authorities. The limiting activity coefficients were determined for some of these compounds in crude and settled sewage. A transpiration method was used to measure the ratio between the vapor pressures of the pure substance and of a low molar concentration of the substance in solution, and the limiting activity coefficient was calculated. Values determined are presented for various organic substances, including toluene, chloroform, benzene, etc. The concept of relative atmospheric toxicity is discussed. (Small-FRC)
W81-01689

SELECTIVE PREDATION BY MYSIDS INLAKE RESTORATION BY BIOMANIPULATION,
Washington Univ., Seattle. Dept. of Zoology.
W. T. Edmondson, and P. Murtaugh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170359, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, September 30, 1980. 28 p, 8 Fig, 4 Tab, 29 Ref. OWRT-A-096-WASH(1), 14-34-0001-9051.

Descriptors: *Lake restoration, *Ecosystems, *Predation, *Lake Washington(WA), *Daphnia, Electivity, Gut contents, Mysid, *Neomysis, Predation, Size selection, Zooplankton, Biomanipulation, Bioassy.

After decades of scarcity or absence, members of the crustacean genus Daphnia have become very abundant in Lake Washington in recent years. One hypothesis to explain the recent success of Daphnia is a decline in the abundance of the predatory crustacean Neomysis mercedis, apparently caused by changes in fish predation. This study focuses on the selection of prey by Neomysis and its relevance to the Lake Washington zooplankton community. In feeding experiments in small containers, clearance rates of Neomysis on Daphnia were roughly two to four times higher than those on the copepond Diaptomus. The 'preference' for Daphnia deduced by comparing gut contents to prey densities in the plankton is much more pronounced, and the cladocerans is consistently selected over all other prey species found in the lake. Small mysids select the smallest Daphnia available, but adult mysids can consume cladocerans as large as 3.0 mm. The pattern of electivity over the manageable size range of prey is variable for large Neomysis, suggesting that mysids may alter their feeding behavior in response to changing availability of prey. Since mysids reproduce seasonally in Lake Washington, their size-frequency distribution is alternately dominated by large and small individuals. Size-related differences in feeding rate and prey selection by the mysids therefore imply that the intensity and character of predation on Daphnia will very seasonally as well.
W81-01696

APPLICATION OF AN EVAPORATIVE LOSS MODEL TO ESTIMATE THE PERSISTENCE OF CONTAMINANTS IN LENTIC ENVIRONMENTS,
Purdue Univ., Lafayette, IN. Dept. of Forestry and Natural Resources.
A. Spacie, J. L. Hamelink, and R. C. Waybrant.
In: Special Technical Publication 634, American Society for Testing Materials, Philadelphia, PA. p 214-227, 1977, 4 Fig, 3 Tab, 19 Ref. OWRT-A-017-IND(5).

Descriptors: *Water analysis, *Toxicology, *Evaporative loss model, Persistence, *Aquatic environment, Ecosystems, Nonionic chemicals, *Lentic environment, Pollutants, Synthetic chemicals, Thermal stratification.

A simple, two-layer model for predicting evaporative losses of nonionic synthetic chemicals from water is presented. Losses from well-stirred small vessels are predicted accurately. Losses from thermally stratified bodies of water were poorly predicted because turbulent mixing processes at the interfaces were retarded.
W81-01698

DETAILED SURFACE WATER QUALITY DATA, SASKATCHEWAN, 1974-1976.
Saskatchewan Dept. of the Environment, Regina. Inland Waters Directorate.
Cat. No EN 36-430/6, ISBN 0-662-50706-1, Minister of Supply and Services Canada. 1980. 339 p, 1 Fig, 330 Tab.

Descriptors: *Surface waters, *Water quality, *Canada, *Baseline studies, *Water analysis, Water properties, Data collections, Rivers, Drainage systems, Drainage water, Freshwater, Running waters, Water resources, Biochemical oxygen demand, Nutrients, Cations, Anions, Trace elements, Organic wastes, Industrial wastes, Water pollution, Solid wastes, Pollutants, Turbidity, Water chemistry, Monitoring, Information exchange, Documentation, Phenols, Hydrogen ion concentrations, *Saskatchewan.

Chemical, physical, and biological surface water data for Saskatchewan, collected during the period 1974 to 1976, are reported. These data are intended to provide a ready reference to the water quality variables that were measured. The data were obtained from a number of Water Quality Branch programs. Included in the measured parameters were: water temperature, specific conductivity, pH, turbidity, apparent color, dissolved oxygen, total/fecal coliforms, chlorophyll a, BOD, total hardness, total dissolved solids, total alkalinity, inorganics (biocarbonate, sulfate, Ca, Mg, Na, K, Cl, F, P, B, Al, V, Cr, Mn, Fe, Cu, Zn, Se, Ag, As, Cd, Ba, Hg, Pb), cyanide, total nitrogen, nitrogen oxides, reactive silica, total organic/inorganic carbon, nitrilotriacetic acid, phenolics, n-alkanes, aromatic hydrocarbons, oil/grease, surfactants and pesticides (up to over 20, including PCB's). Analytical methods used for measurement of parameters are given in six-digit codes with the data. This baseline information supports work for assessing trends in the aquatic environment and impacts of development. This report is the first in a series of detailed water quality data reports to be published on a biennial basis. Earlier data for Saskatchewan were summarized in, 'Water Quality Data, Saskatchewan, 1961-1973'. (Zielinski-IPA)
W81-01702

DETAILED SURFACE WATER QUALITY DATA, ALBERTA, 1974-1976.
Inland Waters Directorate, Calgary (Alberta).
Cat. No EN 36-430/3, ISBN 0-662-50690-1, Minister of Supply and Services Canada. 1980. 440 p, 1 Fig, 393 Tab.

Descriptors: *Surface waters, *Water quality, *Canada, *Baseline studies, *Water analysis, Water properties, Data collections, Rivers, Drainage systems, Drainage water, Freshwater, Running waters, Water resources, Biochemical oxygen demand, Nutrients, Cations, Anions, Trace elements, Organic wastes, Industrial wastes, Water pollution, Solid wastes, Pollutants, Turbidity, Water chemistry, Monitoring, Information exchange, Documentation, Phenols, Hydrogen ion concentration, *Alberta.

Chemical, physical, and biological surface water data for Alberta, collected during the period 1974 to 1976, are reported. These data are intended to provide a ready reference to the water quality variables that were measured. The data were obtained from a number of Water Quality Branch programs. Included in the measured parameters were: water temperature, specific conductivity, pH, turbidity, apparent color, dissolved oxygen, total/fecal coliforms, chlorophyll a, BOD, total hardness, total dissolved solids, total alkalinity, inorganics (biocarbonate, sulfate, Ca, Mg, Na, K, Cl, F, P, B, Al, V, Cr, Mn, Fe, Cu, Zn, Se, Ag, As, Cd, Ba, Hg, Pb), cyanide, total nitrogen, nitrogen oxides reactive silica, total organic/inorganic carbon, nitrilotriacetic acid, phenolics, n-alkanes, aromatic hydrocarbons, oil/grease, surfactants, and pesticides (up to over 20, including PCB's). Analytical methods used for measurement of parameters are given in six-digit codes with the data. This baseline information supports work for assessing trends in the aquatic environment and impacts of development. This report is the first in a series of detailed water quality data reports to be published on a biennial basis. Earlier data for Alberta were summarized in, 'Water Quality Data, Alberta, 1961-1973'. (Zielinski-IPA)
W81-01703

PESTICIDES IN THE RIVERS OF THE KRUGER NATIONAL PARK (PLAAGDODERS IN RIVIERWATER VAN DIE NASIONALE KRUGERWILDTUIN),
Plant Protection Research Inst., Pretoria (South Africa).
L. P. Van Dyk.
Koedoe (Pretoria), No 21, p 77-80, 1978. 1 Tab, 3 Ref.

Descriptors: *Pesticide residues, *Sampling, *Water analysis, *Pesticides, *Pesticide detection, Kruger National Park, *South Africa, Rivers, River pollution, Pollution effects, Endosulfan, Dieldrin, DDT, Chlorinated hydrocarbons.

Rivers flowing into the Kruger National Park were monitored for pesticide residues. Altogether, 657 samples were taken from sites located on the Levubu, Letaba, Olifants, Sabie and Crocodile Rivers, These samples were analyzed over a period of two years and in only 11, or two percent, were pesticide residues found. Endosulfan was found in seven samples at concentrations ranging from 100 to 6300 nanogram per cubic decimeter. Dieldrin was found in two samples at concentrations of 1700 and 2000 nanogram per cubic decimeter, while DDT was found in the other two samples at concentrations of 100 and 500 nanogram per cubic decimeter. In 85 samples, or 13%, unkown chlorinated compounds were found, possibly industrial pollutants. The results of this survey indicated that pesticides in rivers do not pose a serious threat to wildlife in the Kruger National Park. (Stiles-IPA)
W81-01745

WASTE WATER SPRAY TRANSPORT IN LAND APPLICATION,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
P. C. Reist, N. J. Zimmerman, A. G. Turner, D. E. Francisco, and P. Robinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170540, Price codes: A10 in paper copy, A01 in microfiche. Water Resources Research Institute, University of North Carolina, Raleigh, Report No 152, Dec., 1980. 208 p, 23 Fig, 24 Tab. OWRT-B-104-NC(2), 14-34-0001-7176.

Descriptors: *Land application, *Waste water irrigation, Spraying, Aerosols, Tracking techniques, Tagging, Fluorescent dye, Public health, Bacteria, *Spray irrigation, *Pollutant identification, Path of pollutants, E. coli.

The objective of this study of waste water spray transport from land treatment was to generate a model to predict aerosolized viable particle dispersion from a spray system, taking into account the effects of particle size, microorganism viability and meteorological parameters such as solar radiation, relative humidity, temperature, wind speed and wind direction. Two spray solutions, one containing a viable atmospheric tracer, the bacteria E. coli, and the other a non-decaying tracer, the fluorescent dye, uranine, were simultaneously sprayed in an open field to simulate the aerosolized portion of a full-scale irrigation spray. Ambient concentrations were determined by sampling at distances up to 311 meters downwind. Maximum downwind concentrations were estimated from the dye field data for 65 experimental runs. These data combined with monitored meteorological data were analyzed for development of an appropriate atmospheric dispersion model. Viability of the airborne E. coli was determined from comparisons of the bacteria to dye ratios in the spray and in the samplers. Evaluation of typical waste water disposal operations with the emprical model and assumptions about waste water characteristics and spray equipment aerosolization efficiency indicate low levels of pathogens on the order of one per cubic meter expected thirty meters downwind from sprayed unchlorinated secondary waste water effluent or settled raw waste water depending on specific waste water properites.
W81-01761

QUANTITATIVE STUDIES ON A HUMAN PATHOGEN (CANDIDA ALBICANS) AND TRADITIONAL BACTERIAL INDICATORS OF POLLUTION IN DOMESTIC WASTE WATERS AND RECEIVING WATERS,
Connecticut Univ., Storrs. Inst. of Water Resources.
J. D. Buck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170516, Price codes: A02 in paper copy, A01 in microfiche. Research Project Technical Completion Report, 1980. 10 p, 2 Fig, 1 Tab, 4 Ref. OWRT A-085-CONN(2), 14-34-0001-0107.

Descriptors: *Sewage treatment, Indicators, Chlorine, *Sewage bacteria, *Coliforms, Candida albicans, Survival, *Human pathology, *Bioindicators, Bacteria, Water supply, Pollutant identification.

Significant ($p = 0.01$) positive correlations were found between four indicators of sanitary water quality (Total coliforms, fecal coliforms, fecal streptococci, and Pseudomonas aeruginosa) and the human and animal associated pathogenic yeast Candida albicans in samples taken from five waste water treatment plants over a 12 month period. No correlations were found among these indicators in contiguous receiving waters and sediments due to the low number of organisms present. Survival studies using C. albicans were conducted both in the laboratory and in the field. Fieldwork was done using plexiglas chambers. One study showed that survival was shorter in seawater and longer in distilled water, river water, and filtered raw sewage. A second study considered the effects of chlorine on C. albicans. Higher chlorine concentrations, longer exposure times, and lower pH were found to be deleterious to the survival of C. albicans. The results of this study support the potential of C. albicans for possible application as an indicator of sanitary water quality.
W81-01762

ANALYSIS OF TRACE LEVELS OF VOLATILE ORGANIC CONTAMINANTS IN MUNICIPAL DRINKING WATER BY GLASS CAPILLARY GAS CHROMATOGRAPHY USING SIMULTANEOUS FLAME IONIZATION AND ELECTRON CAPTURE DETECTION,
New Orleans Univ., LA. Center for Bio-Organic Studies.
L. V. McCarthy, E. B. Overton, C. K. Raschke, and J. L. Laseter.
Analytical Letters, Vol 13, No A16, p 1417-1429, 1980. 2 Fig, 1 Tab, 21 Ref.

Descriptors: *Halogenated organic compounds, *Organic compounds, *Potable water, *Water analysis, Volatile organic compounds, Analytical techniques, Gas chromatography, *Pollutant identification.

A rapid (40 minute) method for determining trace volatile organic compounds in drinking water used glass capillary gas chromatography with simultaneous flame ionization and electron capture detection. Both halogenated compounds and hydrocarbons were detected simultaneously at less than a microgram per liter for a 5 ml water sample. Some compounds not detected by flame ionization were identified by electron capture detection and vice versa. Purified diethyl ether was used as a solvent in preparing standard solutions. Solution A, which contained 13 organic compounds common in chlorinated water, was used to illustrate the system's resolution capabilities. Solution B, which contained benzene, toluene, and trihalomethanes, was used for quantitative calibrations and reproducibility studies. The coefficient of variance for 6 compounds (benzene, toluene, and trihalomethanes) was 80% or better in 20 replicate analyses. (Cassar-FRC)
W81-01768

COMBINED MEMBRANE FILTRATION-ELECTROCHEMICAL MICROBIAL DETECTION METHOD,
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
J. R. Wilkins, D. C. Grana, and S. S. Fox.
Applied and Environmental Microbiology, Vol 40, No 4, p 852-853, October, 1980. 3 Fig, 1 Ref.

Descriptors: *Microbiology, *Membranes, *Filtration, Water analysis, Microorganisms, E. coli, Analytical techniques, *Pollutant identification, Coliforms.

E. coli were concentrated by membrane filtration and counted by platinum electrode detection. Bacteria were determined in 100 ml samples of undiluted estuarine and fresh water as well as in water diluted ten-fold and 100-fold. E. coli results compared favorably with previously estimated data in which platinum electrodes were tested in a broth-test tube setup. S. aureus produced erratic results. This combined technique may be a rapid and effective method for estimating microbial loading of water samples. (Cassar-FRC)
W81-01769

AUTOMATIC WATER QUALITY ANALYZERS FOR WASTE WATER COLLECTION AND TREATMENT,
Public Works Research Inst., Ibaraki (Japan).
K. Murakami.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 938-942, May, 1980.

Descriptors: *Monitoring, *Water quality, *Instrumentation, *Toxins, Analytical techniques, Chromium, Cadmium, Copper, Waste water treatment, Cyanide, Selective ion electrodes, *Japan.

By June, 1981, Japanese waste water treatment plants are required to use automatic analyzers for continuous monitoring and recording of organic loadings from treatment plants. Reliable automatic analyzers are needed to monitor hazardous substances, and work on several analyzers still in the developmental stages is summarized. A total cyanide analyzer is being developed which measures cyanide with a cyanide-selective ion electrode after removal of sulfur ions. A total chromium analyzer is a batch type model which uses an automatic background correction mechanism comprising a system of pre-oxidation by aeration before the addition of potassium permanganate. A hexavalent chromium analyzer using the ultraviolet absorption measurement method is under development. The cadmium analyzer uses cadmium ion-

selective electrodes as detection units. The bathocuproine method for cuprous ion analysis is used by the copper analyzer. Analyzers for organic substances are also under development. (Small-FRC)
W81-01798

RECENT CONCEPTS AND DEVELOPMENT OF AN AUTOMATED BIOLOGICAL MONITORING SYSTEM,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
D. Gruber, J. Cairns, Jr., K. L. Dickson, A. C. Hendricks, and W. R. Miller, III.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 465-471, March, 1980. 7 Fig, 18 Ref.

Descriptors: *Monitoring, *Fish, *Ventilation, Model studies, *Bioindicators, *Water quality, Sodium compounds, Chlorine, Ventilatory frequencies, Breathing rate.

The possibility of using fish breathing behavior coupled with chemical/physical monitoring to monitor water quality is discussed. An apparatus is described containing 24 monitor tanks of bluegill. The system was first tested with 5 mg/liter sodium hypochlorite solution; the second test exposed fish to Arbitrary Reference Mixture, a standard developed for the petroleum industry. Chlorinated tap water was also used as a test solution. The primary response of the ventilatory behavior of bluegill to a strong solution of sodium hypochlorite was a significant decrease in the strength of the signals. Coughing also increased. The ventilatory response of fish exposed to ARM was similar. There was an initial decrease in ventilatory frequencies upon exposure to chlorinated tap water. These preliminary results indicate that biological monitoring is a feasible concept. An adequate statistical package capable of detecting abnormal breathing rates is needed. (Small-FRC)
W81-01844

STUDIES ON THE TOXICITY OF PULP AND PAPER MILL EFFLUENTS-I. MUTAGENICITY OF THE SEDIMENT SAMPLES DERIVED FROM KRAFT PAPER MILLS,
Shizuoka Coll. of Pharmaceutical Sciences (Japan).
N. Kinae, T. Hashizume, T. Makita, I. Tomita, and I. Kimura.
Water Research, Vol 15, No 1, p 17-24, January, 1981. 7 Fig, 7 Tab, 19 Ref.

Descriptors: *Genetics, *Effluents, *Toxicity, *Pulp wastes, *Analytical techniques, Industrial wastes, Water pollution sources, Water analysis, Assay, *Pollutant identification, Evaluation, Mass spectrometry, Gas chromatography.

Sediments from three coastal sites were assayed for mutagenic substances in an attempt to determine effects of nearby pulp and paper mill effluents. Among 28 compounds identified and tested, fluoranthene, pyrene, 2,6-di-tert-butyl-4-methylphenol, dihydroactinidiolide and juvabione were newly identified compounds of the sediments from the paper mill. Extracts were fractionated by the application of high-speed liquid chromatography and subjected to rec and reversion assay with B. subtilis and S. typhimurium and applied to gas chromatography - mass spectrometry analysis. (Titus-FRC)
W81-01846

TOTAL MERCURY AND METHYL MERCURY LEVELS IN BRITISH ESTUARINE SEDIMENTS - II,
Cape Town Univ. (South Africa).
P. D. Bartlett, and P. J. Craig.
Water Research, Vol 15, No 1, p 37-47, January, 1981. 14 Fig, 4 Tab, 22 Ref.

Descriptors: *Mercury, *Estuaries, Statistical methods, Sediments, Sampling, Organic compounds, Chemical analysis, Bacteria, Correlation analysis, *Pollutant identification, Path of pollutants, United Kingdom.

Results of various studies of total mercury and methylmercury levels in British estuarine sediments are discussed. Methylmercury formed an average of 0.46% of the total mercury present. Both mercury and methylmercury are associated with the silt fraction and organic rich sediments. Redox potential was found to influence the ambient level of methyl mercury. Data suggest that high sulfide levels enhance dimethyl mercury production in an aerobic environment. Additional research is needed on the relationship of methylmercury levels in sediments to microbiological activity. (Titus-FRC)
W81-01856

EVALUATION OF THE FALSE-POSITIVE ENTEROVIRAL PLAQUE PHENOMENON OCCURRING IN SEWAGE SAMPLES,
Hadassah Medical School, Jerusalem (Israel).
S. Kedmi, and B. Fattal.
Water Research, Vol 15, No 1, p 73-74, January, 1981. 1 Tab, 10 Ref.

Descriptors: *Viruses, *Epidemiology, *Laboratory tests, Water pollution, *Pollutant identification, Microorganisms, Toxicity, Waste water treatment, Sewage, Bacteria, Methodology, Sampling, Groundwater.

Laboratory procedures for limiting false-positive evaluation of viral plaques are discussed. Three samples of sewage, sewage effluent and polluted groundwater were analyzed using the plaque method. Plaques were randomly chosen and further investigated for enteroviruses using a tissue culture system. A large dose of antibiotics was always added to the sewage concentrate before inoculation into the BGM cell cultures. Plaques which appeared irregular were examined under a microscope. Areas in the tissue culture being evaluated as possible viral plaques in whose vicinity an unidentified particle was seen microscopically were not included in the results. Questionable plaques which could be non-viral were also excluded. It was found that prevention of contamination, stringent examination of plaques, and the short evaluation time used decreased the incidence of false positive results. However, this method may cause underestimation of the true viral concentration. (Titus-FRC)
W81-01857

THE EFFECT OF SURFACTANTS ON THE MIXED CHELATE EXTRACTION-ATOMIC ABSORPTION SPECTROPHOTOMETRIC DETERMINATION OF COPPER, NICKEL, IRON, COBALT, CADMIUM, ZINC AND LEAD,
Australian Atomic Energy Commission Research Establishment, Lucas Heights.
P. Pakalns.
Water Research, Vol 15, No 1, p 7-11, January, 1981. 3 Tab, 2 Ref.

Descriptors: *Surfactants, *Metals, *Spectrophotometry, Analytical techniques, Chelation, Detergents, Mass spectrometry, Chemical analysis, Separation techniques, *Trace elements, Ions.

The possible interference of various surfactants with detection of trace metals in natural waters was investigated. Standard volumes of trace metals were added to surfactant solutions and analyzed by atomic absorption spectrophotometry. It was found that cationic detergent interfered badly with the determination of cobalt and to some extent with cadmium, but for the remainder of the metals investigated, cationic detergent at 10 milligrams per liter gave recoveries between 95 and 103%. Non-ionic detergent also interfered badly with the determination of cobalt. Sodium pyrophosphate and sodium tripolyphosphate interfered significantly with iron and cadmium determination. NTA gave low recoveries for nickel and lead. In polluted natural waters a mixed-chelate method of extraction produced 100% recoveries for all seven metals extracted, and the ammonium pyrolidinedithiocarbamate, or APDC method of extraction required additions of aluminum to release nickel, iron and cobalt from complexiang agents. (Titus-FRC)
W81-01859

EFFECTIVENESS OF THE ORGANIC FLOCCULATION METHOD IN CONCENTRATING ECHOVIRUS 7 AND COXSACKIEVIRUS A9 FROM WATER,
Hadassah Medical School, Jerusalem (Israel).
S. Kedmi, and B. Fattal.
Water Research, Vol 15, No 1, p 13-15, January, 1981. 3 Tab, 7 Ref.

Descriptors: *Public health, *Potable water, *Viruses, *Laboratory tests, *Pollutant identification, Epidemiology, Aquatic microbiology, Microorganisms, Water pollution sources, Water analysis, Testing, Sewage.

A method of detecting low levels of water-borne viruses in drinking water is proposed. It involves two steps, adsorption-beef extract elution and organic flocculation. Studies conducted with echovirus and coxsackievirus produced mean recovery efficiencies of 75%. Results suggest that the method has potential application to commonly found enteroviruses other than polioviruses. (Titus-FRC)
W81-01860

5B. Sources Of Pollution

TRIHALOMETHANES: IMPACT OF BROMIDE ION CONCENTRATION ON YIELD, SPECIES DISTRIBUTION, RATE OF FORMATION AND INFLUENCE OF OTHER VARIABLES,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
R. A. Minear, and J. C. Bird.
In: Water Chlorination, Environmental Impact and Health Effects, Vol 3, p 151-160, 1980. 6 Fig, 2 Tab, 10 Ref. Ann Arbor Science, Ann Arbor, Michigan. OWRT-A-051-TENN(2), 14-34-0001-0145.

Descriptors: *Trihalomethanes, *Water treatment, *Bromides, Carcinogen, *Potable water, *Tennessee, Chloroform, Sampling, Water analysis, Raw water, Treated water, Water pollution, Seasonal.

The objective of this study was to examine the effect of bromide concentration on trihalomethane formation under a variety of conditions that would simulate the drinking water treatment process, by means of lab-scale experiments. Results indicate that bromide concentration directly affects the rate of formation of trihalomethanes, the ultimate concentration after reaction, and the product distribution among the four expected trihalomethanes. Additionally, it was found that the bromide concentration influences the effects of both temperature and chlorine dose on trihalomethane formation. Conclusions indicate the significance of bromide levels in water supplies that are chlorinated.
W81-01656

WATER-QUALITY ASSESSMENT OF THE CYPRESS CREEK WATERSHED, WARRICK COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
L. L. Bobo, and C. A. Peters.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-221989, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-35, May 1980. 67 p, 17 Fig, 12 Tab, 34 Ref.

Descriptors: *Water quality, *Assessments, *Watersheds(Basins), *Mine drainage, *Indiana, Surface waters, Measurement, Watershed management, Flood control, Erosion control, Sediment control, Coal mine wastes, Path of pollutants, Water pollution sources, Chemical analysis, Bacteria, Pesticides, Water analysis, Warrick County(IN), Cypress Creek(IN).

The U.S. Soil Conservation Service needs chemical, biological, microbiological, and hydrological data to prepare an environmental evaluation of the water quality in the Cypress Creek watershed, Warrick County, Ind., before plans can be devised to (1) improve water quality, (2) minimize flood-

ing, (3) reduce sedimentation, and (4) provide adequate outlets for drainage in the watershed. The U.S. Geological Survey obtained these data for the Soil Conservation Service in a water-quality survey of the watershed from March to August 1979. Past and present surface coal mining is the factor having the greatest impact on water quality in the watershed. The upper reaches of Cypress Creek receive acid-mine drainage from a coal-mine waste slurry during periods of intense rainfall. All the remaining tributaries, except Summer Pecka ditch, drain mined or reclaimed lands. The general water type of Cypress Creek and most of its tributaries is calcium and magnesium sulfate. In contrast, the water type at background site 21 on Summer Pecka ditch is calcium sulfate. Specific conductance ranged from 470 to 4,730 micromhos per centimeter at 25 degrees Celsius, and pH ranged from 1.2 to 8.8. Specific conductance, hardness, and concentrations of major ions and dissolved solids were highest in tributaries affected by mining. The pH was lowest in the same tributaries. Concentrations of iron, manganese, and sulfate in water samples and chlordane, DDT, and PCB's in streambed samples exceeded water-quality limits set by the U.S. Environmental Protection Agency. (USGS)
W81-01664

INVESTIGATION OF ACIDITY AND OTHER WATER-QUALITY CHARACTERISTICS OF UPPER OYSTER CREEK, OCEAN COUNTY, NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
T. V. Fusillo, J. C. Schornick, Jr., H. E. Koester, and D. A. Harriman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-103889, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-10, July, 1980. 30 p, 10 Fig, 4 Tab, 21 Ref.

Descriptors: *Water quality, *Acidic water, *Hydrogen ion concentration, *Surface waters, *New Jersey, Groundwater, Swamps, Streamflow, Precipitation(Atmospheric), Chemical analysis, Data collections, Oyster Creek(NJ), Ocean County(NJ).

Water-quality data collected in the upper Oyster Creek drainage basin, Ocean County, N.J., indicate that the stream has excellent water quality except for a persistently low pH. The mean concentrations of the major inorganic ions were all less than 6.0 milligrams per liter. Mean concentrations of total nitrogen and total phosphorus were 0.15 mg/L and 0.01 mg/L, respectively. Dissolved oxygen averaged 8.7 mg/L and 81% saturation. Low pH levels are typical of streams draining cedar swamps. In Oyster Creek, the pH tended to decrease downstream due to chemical and biological processes. The pH levels in swamps were one-half unit or more lower than the pH levels in the adjacent stream. Sharp declines in stream pH were noted during runoff periods as the result of the mixing of poorly-buffered stream water with more highly acidic water from surrounding swamp areas. The quality of ground water within the study area was similar to the quality of streamflow, except for higher iron and ammonia-nitrogen concentrations and a higher pH range of 4.9 to 6.5. Precipitation represented a major source of many chemical constituents in the ground- and surface-waters of the Oyster Creek basin. (USGS)
W81-01665

WATER QUALITY OF THE NEUSE RIVER, NORTH CAROLINA--VARIABILITY, POLLUTION LOADS, AND LONG-TERM TRENDS,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 5A.
W81-01668

QUALITY OF WATER AND TIME OF TRAVEL IN YOCKANOOKANY RIVER, CHOCTAW COUNTY, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
G. A. Bednar.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $4.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-770, 1980. 33 p, 5 Fig, 2 Tab, 9 Ref.

Descriptors: *Water quality, *Streamflow, Surface waters, *Mississippi, Hydrologic data, Dye releases, Tracking techniques, Water analysis, Bacteria, *Path of pollutants, Water pollution sources, Time of travel, *Choctaw County(MS), *Yockanookany River(MS).

An intensive water-quality study along a 3.3 mile reach of the Yockanookany River, Choctaw County, Miss., was conducted on August 29-31, 1978. Water-quality data were collected during a period of generally low streamflow and seasonally high air temperatures. The dissolved-solids concentrations were less than 50 milligrams per liter. In the water leaving the study reach, the ammonia nitrogen concentration ranged from 0.10 to 0.40 milligrams per liter and total phosphorus concentrations ranged from 0.14 to 0.43 milligrams per liter. The 5-day biochemical oxygen demand was generally less than 6.0 milligrams per liter and dissolved-oxygen concentrations ranged from 5.5 to 8.1 milligrams per liter. Fecal bacteria densities were high. Fecal streptococcal bacteria in the water leaving the study reach ranged from 460 to 13,000 colonies per 100 milliliters. The rate of solute travel was 0.15 miles per hour through the study reach. (USGS)
W81-01675

SOURCES OF TOXIC COMPOUNDS IN HOUSEHOLD WASTEWATER,
Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Div.
S. W. Hathaway.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-110942, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-128, August, 1980. 90 p, 5 Tab, 15 Ref, 1 Append.

Descriptors: *Domestic wastes, *Pollutants, *Waste water(Pollution), *Water pollution sources, Solvents, Heavy metals, Phenols, Pesticides, Paints, Water pollution, Chemicals, Toxins, Toxic substances, Waste water treatment.

Although it is assumed that the largest contribution of toxic pollutants is from industrial discharges, the identification and concentration of these pollutants from strictly domestic wastewater sources is largely unknown. The occurrence of toxic chemicals in the household wastewater is of great concern not only for municiple wastewater treatment plant discharges but more importantly for small community systems and single dwelling wastewater treatment systems which may have an impact on the ground water quality. This report presents the results of a literature search into the occurrence of the Environmental Protection Agency's selected 129 priority pollutants in household wastewater. Consumer product categories and general types of products containing the toxic compounds used in and around the home are identified. The most frequently used products containing toxic chemicals are household cleaning agents and cosmetics. Solvents and heavy metals are the main ingredients of these products, which are used on a daily basis. Deodorizers and disinfectants containing naphthalene, and phenol and chlorophenols, are also high on the frequency list. Pesticides, laundry products, paint products, polishes, and preservatives are wasted infrequently but are commonly wasted in large volumes. Thus the fate of low level frequent discharges and high level infrequent discharges of toxic chemicals must be addressed in further research work with individual wastewater treatment systems or small community systems. (Moore-SRC)
W81-01683

DISSOLVED OXYGEN MEASUREMENTS IN OHIO STREAMS FOLLOWING URBAN RUNOFF,
Ohio State Univ., Columbus. Water Resources Center.
R. C. Stiefel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-222045, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-092, July, 1980. 84 p, 13 Fig, 1 Tab. R805201-01.

Descriptors: *Urban runoff, *Dissolved oxygen, *Water quality, *Storm runoff, Flow rates, Cities, Ohio, Combined sewers, Water pollution, Streams, Precipitation, Evaluation.

Thirteen towns and cities in Ohio, situated on streams and rivers having different mean daily flow rates, were investigated during the summer and spring of 1977 to determine their suitability as sites for more extensive field studies on the impacts of urban runoff on dissolved oxygen (D. O.) levels in the streams. The towns included Akron, Bucyrus, Delphos, Findlay, Lancaster, Lima, Newark, Norwalk, Tiffin, Upper Sandusky, Wapakoneta, Washington Court House and Wooster. Among factors considered in the selection process were a demonstrable impact of the urban runoff on D. O. levels, accessibility to stream sampling locations, and the availability of stream and precipitation gages. Sites were rejected because (1) poor quality effluents from municipal and industrial treatment plants masked the impacts of combined sewer overflows (CSOs); (2) stream drainage pattern was too complex to monitor; or (3) impacts of the CSOs did not decrease the D. O. to less than 5 mg/l. Only the towns of Lancaster, Newark and Wapakoneta satisfactorily met the criteria established to qualify them as locations for more extensive field studies. (Author's abstract)
W81-01684

MAXIMUM UTILIZATION OF WATER RESOURCES IN A PLANNED COMMUNITY; CONTRIBUTIONS OF REFRACTORY COMPOUNDS BY A DEVELOPING COMMUNITY,
Rice Univ., Houston, TX. Dept. of Biology.
F. M. Fisher.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-112880, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-113, August, 1980. 81 p, 7 Fig, 4 Tab, 3 Ref, 2 Append. 802433.

Descriptors: *Chlorinated hydrocarbon pesticides, *Polychlorinated biphenyls, *Community development, *Water pollution, Water resources development, Pesticide residues, Road construction, Land forming, Golf courses, Soil contamination, Artificial lakes, Drainage system, Fish, Storm water, Return flow, Mirex, Chlordane, Water utilization, Environmental effects, Planned community.

This project was undertaken to examine the role of a developing community in contributing refractory organochlorine compounds to the aquatic ecosystem. Water, soil, and biotic components from a natural drainage system in The Woodlands, Texas, were assayed for halogenated compounds. In addition, components from two man-made lakes and the recipient stream were evaluated. Polychlorinated biphenyl (PCB) residues were detected during each year of the three-year study. The levels of PCBs were highest during the first year (about 350 ppb in soil and animal samples) and diminished to 1/10 of those values during the second and third years of study. The highest residue values were coincident with the period of development when cut and fill operations, roadbed construction, and service installation were being effected. Mirex was found in soil, water, and organisms from the drainage area around The Woodlands Golf Course, as were residues of chlordane. The pesticide levels in fish never exceeded 5.6 ppb for mirex and 6.1 ppb for chlordane. Both compounds were apparently transported into the Conference Center Lakes by stormwater or washed in by returning irrigation water from the golf course. Fish from Panther Branch, which receives stormwaters from overlfow of the Conference Center Lakes, contained less than one fourth the amount of mirex and chlordane found in golf course sam-

plings. The data indicated that biotic and abiotic components of the lakes serve as effective sumps for these pesticides. (Moore-SRC)
W81-01686

THE EFFECTS OF LIGHT ON THE DISSIPATION OF CHLORINE IN SEA-WATER,
Old Dominion Univ., Norfolk, VA. Inst. of Oceanography.
G. T. F. Wong.
Water Research, Vol 14, No 9, p 1263-1268, September, 1980. 4 Fig, 1 Tab, 17 Ref.

Descriptors: *Sea water, *Chlorination, Ambient light, Laboratory tests, Light intensity, *Light penetration, *Chlorine, Bromine, *Chemical reactions, Dissipation, Residual chlorine, *Chesapeake Bay.

A laboratory investigation of the effects of light on the dissipation of chlorine in sea water samples collected near the mouth of the Chesapeake Bay is reported. Bromate is one of the products formed when chlorinated sea water is exposed to light; the rate and amount of bromate formation increase with the intensity of the light. The increase of chlorine demand in the presence of light can be accounted for only partially by the formation of bromate. Other, unidentified reactions must also occur. Even in the absence of light some unidentified species are formed. Thus, the effects of light on the rate and mechanism of the dissipation of residual chlorine can be significant even at low light intensities. Future studies should consider the fate of chlorine in the light and in the dark. The many possible products formed during the chlorination of sea water must be determined, and their toxicity assessed. (Small-FRC)
W81-01690

MATHEMATICAL MODEL FOR WATER QUALITY IN STREAMS IMPACTED BY POINT AND NONPOINT SOURCE POLLUTION,
Kentucky Water Resources Research Inst., Lexington.
M. E. Meadows.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170367, Price codes: A04 in paper copy, A01 in microfiche. Research Report No 126, 1981. 60 p, 8 Fig, 3 Tab, 23 Ref. OWRT-A-078-KY(1), 14-34-0001-9019, 14-34-0001-0119.

Descriptors: *Storm runoff, Small watersheds, Storm water, *Water pollution, *Streamflow, *Model studies, Water quality, Streams, Mathematical models, *Path of pollutants, Pollutant transport, Storm water quality, Nonpoint source pollution, Water quality modeling, Unsteady streamflow, Kinematic streamflow.

Modeling the impacts of stormwater runoff on small streams requires that the prediction model has the capability of simulating the behavior of the hydrologic and water quality components of the stream system. Development of such a model involves coupling the equations for pollutant transport during flow with the appropriate flood routing equations. The decision on which equations to choose requires a full understanding of the pollutant transport and hydrograph dispersion processes. This research was undertaken to develop a rigorous theoretical evaluation of the pollutant transport and hydrograph dispersion process during unsteady flow, and to recommend a suitable model for simulating the impact of stormwater on small streams. It was determined that the one dimensional convective - dispersive equation for tracers (pollutants) coupled with a form of the diffusive wave model for unsteady streamflow would provide the basis for a simulation model that is both simple and consistent with the principal transport process. Evaluation of the dynamic terms in the momentum equation yielded general estimators to model parameters and established that the Muskingum routing model is consistent with the modified diffusive wave model developed during this research. The coefficient for hydrograph dispersion was tested on tracer dispersion data and was found to be a reasonable prediction equation for channels with top widths less than 115 feet and bed slopes greater than 1.6 feet per mile. Most small streams satisfy these conditions.
W81-01694

NON-POINT SOURCE POLLUTION IN FOREST STREAMS OF THE WESTERN OLYMPIC MOUNTAINS,
Washington Univ., Seattle. Coll. of Forest Resources.
D. D. Wooldridge, and A. G. Larson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170342, Price codes: A06 in paper copy, A01 in microfiche. Project Completion Report, September 5, 1980. 103 p, 27 Fig, 9 Tab. OWRT-B-076-WASH(1), 14-34-0001-8127.

Descriptors: *Water pollution sources, *Forest watersheds, *Washington, *Non-point pollution, Road construction, Clear-cutting, Overland flow, Streams, Inflow, Dissolved solids, Nutrient cycling, Suspended sediment, Forest ecosystems, Forest management.

Several watershed studies of forest ecosystems have identified inputs of certain elements in precipitation and outputs from the ecosystem in streamflow. Effects of silvicultural activities on the elemental composition, sediment, and temperature of streamflow also have been reported. This study of experimental watersheds in the western Olympics subdivided the forest ecosystem into zones and identified the concentrations and elemental migration of certain elements between zones. Initial study identified processes of the undisturbed forest. Alteration of these processes by road construction and clearcut forest harvest also was studied. The mode of study evaluated the effects of silvicultural activities on non-point sources pollution with use of Best Management Practices for road construction, felling and bucking of timber, and yarding. Concepts and principles of environmental geochemistry were incorporated in the analyses of cause and effect relationships between ecosystem processes, non-point sources of pollution, and water quality. Elemental migration through zones of the ecosystems is related to abundance and characteristics of the element as well as biological processes. Dissolved constituents found in streamflow of the western Olympics have their primary source in geochemical weathering of parent materials and bedrock. HCO sub 3, Ca, SiO sub 2-Si, and Cl were dominant constituents of streamflow (65, 19, 6, 4%, respectively). Based on initial comparisons of dissolved constituents in streams for pre- and postlogging in this study, and results of other studies, it is concluded that the dissolved water quality of streams from managed forest watersheds will exceed both the drinking water quality standards and the median quality currently used by the 100 largest U.S. cities.
W81-01695

SEASONAL VARIATIONS IN TRIHALOMETHANE LEVELS IN AN IOWA RIVER WATER SUPPLY,
Oklahoma State Univ., Stillwater.
J. N. Veenstra, and J. L. Schnoor.
Journal of the American Water Works Association, Vol 72, No 10, p 583-590, October, 1980. 13 Fig, 4 Tab, 23 Ref. OWRT-A-072-IA(1).

Descriptors: *Iowa River, Fluctuations, Water treatment, *Organic compounds, Iowa, Wells, Rivers, Seasonal, Oxidation, Temperature, Hydrogen ion concentration, Physical properties, Chlorination, Gas chromatography, Bromides, Water pollution sources, Solar radiation, *Humic acids, *Fulvic acids, Potable water, *Trihalomethane.

Water samples taken at two sites along the Iowa River, one upstream and one downstream from the Coralville Reservoir were analyzed for seasonal variations in trihalomethane (THM) levels. Total THM (TTHM) levels at the Coralville well and the effects of chlorination and solar radiation upon THM production in Iowa River water were also examined. Results of gas chromatographic studies on water samples indicated that humic and fulvic acids were the predominant peaks showing seasonal variations. TTHM levels varied seasonally from 50 to 335 micrograms/liter in samples concentrated about 1.4 times. Brominated THM levels were highest in late fall and winter coinciding with patterns of bromide ion concentrations. It was concluded that seasonal variations in the nature of the precursors was the main determinant of final TTHM levels in Iowa River water. Temperature and pH had little effect on THM seasonal variations. Water samples from the Coralville well contained haloforms which were composed of about 88% brominated compounds as compared to surface water which was made up of 27% brominated compounds in its haloform composition. When the point of chlorination was moved back in the treatment of the Iowa River water, TTHMs were produced. Solar radiation reduced THM production by reducing chlorine content of the water rather than by reducing the level of THM precursors. (Geiger-FRC)
W81-01709

CAPACITY OF ACTIVATED SLUDGE SOLIDS FOR VIRUS ADSORPTION,
California Univ., Los Angeles. Dept. of Chemical, Nuclear and Thermal Engineering.
For primary bibliographic entry see Field 5D.
W81-01710

ADSORPTION MASS TRANSFER MODEL FOR VIRUS TRANSPORT IN SOILS,
California Univ., Los Angeles. Dept. of Chemical, Nuclear, and Thermal Engineering.
V. L. Vilker, and W. D. Burge.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-127210, Price codes: A04 in paper copy, A01 in microfiche. Water Research, Vol 14, No 7, p 783-790, July, 1980. 6 Fig, 3 Tab, 13 Ref. (California Water Resources Center Project UCAl-WRC-W-523). OWRT-B-184-CAl(7).

Descriptors: *Viruses, *Mathematical models, Bacteriophage, Soil testing, Soil properties, Isotherm, Adsorption, Aquatic microbiology, Activated carbon, Columns, Migration, *Path of pollutants, Mass transfer, Soils.

An adsorption mass transfer model was applied to describe virus association with soils and soil components. The analysis indicates that virus adsorption to activated carbon, soils, and soil components is saturation limited. Although the number of adsorption sites, Q, is large, the association of virus particles with them is characterized as weak due to the small value of the isotherm equilibrium parameter K sub L. An adsorption mass transfer model adequately describes the rate of adsorption in batch systems and percolating soil beds. The method was illustrated by calculation of the bacteriophage theta xi-174 profiles in a column of silt loam soil. Animal virus profiles in specific soils can be calculated by the same method when the isotherm parameters K sub L and Q and the mass transfer coefficient K sub f are known. Verification of this model by experimental studies with virus-soil adsorbent systems for which these parameters are known is needed, especially for the animal viruses. Future models will require that the timescale of transport through soil beds of practical depths found in the field incorporate the effect of natural inactivation in order to assess virus breakthrough. (Snyder-California)
W81-01711

A SUBSURFACE WATER QUALITY MODEL FOR WESTERN SURFACE MINE SITES,
North Dakota Water Resources Research Inst., Fargo.
R. D. Koob, D. E. Tallman, G. Groenewald, B. Rehm, and J. Cherry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170557, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, Feb., 1981. 4 p. From Symposium on Surface Mining Hydrology, Univ. of Kentucky, Lexington, Dec 1-5, 1980, p 465-473. OWRT-B-053-NDAK(1), 14-34-0001-9089.

Descriptors: Geochemistry, *Hydrogeology, Surface runoff, *Mining, Industrial wastes, *Subsurface waters, *Water pollution sources, Model studies, Water quality, Soil analysis, Soil chemistry, Clay minerals, Soil chemical properties, Mineralogy, Mining engineering, Strip mines, Water analysis, Groundwater, Analysis, Anions, Cations, Ions, Planning, Forecasting, Projections, Estimating, North Dakota, Wyoming, Montana, Canada, *Baseline studies, Strip mines.

Regional similarities in chemical characteristics of shallow groundwater were indicated from hydrochemical data from proposed surface mining sites in North Dakota, Montana, Wyoming, and Alberta. Groundwater similarity characteristics were noted for dominant anions (sulfate and bicarbonate) and cations (sodium and calcium), pH (7-9), and electrical conductance of shallow groundwater (500-4500). A hydrogeochemical model was developed for this region, based on mineralogical data and unsaturated/saturated zone hydrochemical characteristics. Critical hydrogeochemical processes were considered. Mineralogical variability results in significant groundwater quality differences within/between proposed mining sites. The model suggests a severe potential for groundwater degradation in certain Northern Great Plains (NGP) mine settings, especially where unoxidized pyritic and sodium montmorillonitric overburden exist in the near-surface weathering zone (sulfate and sodium in NGP spoils range up to 10 grams/liter and 3.5 grams/liter, respectively, in sodic-pyritic overburden areas). Groundwater degradation can be minimized if key mineralogical variables (as a function of the original sediment depositional settings) are understood and integrated within the mine design framework. (Zielinski-IPA)
W81-01751

WASTE WATER SPRAY TRANSPORT IN LAND APPLICATION,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5A.
W81-01761

EVALUATION OF MANGEMENT PRACTICES ON THE BIOLOGICAL AND CHEMICAL CHARACTERISTICS OF STREAMFLOW FROM FORESTED WATERSHEDS,
Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 4C.
W81-01763

BACTERIAL AEROSOLS PRODUCED FROM A COOLING TOWER USING WASTE WATER EFFLUENT AS MAKEUP WATER,
Army Proving Ground, Dugway, UT.
A. P. Adams, M. Garbett, H. B. Rees, and B. G. Lewis.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 498-501, March, 1980. 3 Tab, 6 Ref.

Descriptors: *Cooling water, *Bacteria, *Reclaimed water, Effluents, Chlorine, Cooling towers, Coagulation, Aerosols, Air pollution, Nutrients.

The potential aerosol hazard produced by the use of waste water effluent as make-up water for cooling towers was investigated, and methods for controlling the bacteria were studied. Bacteria found in the cooling water basin at an 85 MW plant in the southwestern US were determined, and bacteria bearing particles exiting the cooling towers were measured. Chlorine was effective in reducing the number of bacteria, while coagulation was even more effective. However, after all treatments, the total number of bacteria in the tower, except for enteric bacteria, increased rapidly. While coagulation treatment reduced the amount of phosphate and bacteria in the effluent of the plant, it had little effect on removing dissolved nutrients, as was demonstrated by the regrowth of Pseudomonas. An electric utility using chlorine dioxide as a tower disinfectant emitted fewer bacteria-bearing particles. However, an electric utility using pollut-ed river water as cooling water emitted the most bacteria. (Small-FRC)
W81-01764

POLIOVIRUS RETENTION IN 75-CM SOIL CORES AFTER SEWAGE AND RAINWATER APPLICATION,
Brookhaven National Lab. Upton, NY. Dept. of Energy and Environment.
E. F. Landry, J. M. Vaughn, and W. F. Penello.
Applied and Environmental Microbiology, Vol 40, No 6, p 1032-1038, December, 1980. 2 Fig, 3 Tab, 20 Ref.

Descriptors: *Viruses, *Water pollution sources, *Polio viruses, *Soil contamination, Public health, Path of pollutants, Cores, Sewage effluent, Rain water, Recharge, Groundwater recharge, Infiltration rates, Soil water movement, Long Island, Adsorption, Microorganisms.

Guanidine-resistant poliovirus LSc was chosen as a test strain to measure adsorption by Long Island soils in an experimental recharge basin. Polyvinyl chloride pipes were driven into the basin surface. The soil within the pipes was infiltrated at the rate of 1 cm per hour with seeded sewage effluent and allowed to drain. Analysis of the viruses in the 75 cm soil core showed that 77% of the viruses were adsorbed in the first 5 cm, 11% in the second 5 cm segment, 8% in the 10 to 30 cm section, and 4% uniformly distributed throughout the remainder of the 75 cm length. Less than 0.22% was detected in the core filtrates. Rinsing with either sewage effluent or rain water eluted only an additional 0.16%, showing that there was little virus movement from the core. Migration within the core was studied by rinsing virus-treated soil with rainwater and sewage effluent. In the top 5 cm segment, these did not differ from the control. In the 5 to 10 cm section, the control contained 9.29% of the viruses; rain water-rinsed, 18.25%; and sewage-rinsed, 4.36%. No significant differences were seen in the 10 to 15 cm section. In the rain water core, viruses apparently migrated from the middle section into the deeper part. Sewage-rinsed soil contained more viruses at the 25 to 50 cm depth than the control, but less than rain water. Although this data is typical for a number of enterovirus types, it may not apply to other soils, higher infiltration rates, and viruses which adsorb poorly in soils. (Cassar-FRC)
W81-01770

EFFECTS OF ENVIRONMENTAL VARIABLES AND SOIL CHARACTERISTICS ON VIRUS SURVIVAL IN SOIL,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
C. J. Hurst, C. P. Gerba, and I. Cech.
Applied and Environmental Microbiology, Vol 40, No 6, p 1067-1079, December, 1980. 10 Fig, 2 Tab, 18 Ref.

Descriptors: *Soil properties, *Viruses, *Waste water disposal, *Regression analysis, *Water pollution sources, Variability, Microorganisms, Soil moisture, Hydrogen ion concentration, Adsorption, Phosphorus compounds, Aluminum, Organic matter, Temperature, Disposal, Conductivity, Cation exchange, Ultimate disposal, Sewage effluent.

The effects of soil and environmental variables on the persistence of waste water viruses in soil were studied using test samples of soil wetted with suspensions of virus in distilled water, secondary sewage effluent, or mixtures of effluent and water. Virus strains used were coxsackieviruses A9 and B3, echovirus 1, poliovirus 1, rotavirus SA11, and bacteriophages T2 and MS2. Temperature had a large effect on survival of the viruses, inactivation rates increasing with temperature. Virus survival under aerobic nonsterile conditions was less than that occurring in other conditions tested--aerobic sterile, anaerobic sterile, and anaerobic nonsterile. As soil moisture increased, virus survival decreased to a minimum at 15%, then increased with added soil liquid. Considering 10 soil characteristics, the most influential (virus adsorption to soil, extractable phosphorus, exchangeable aluminum, and pH) accounted for 51% of all the variance in the experiment. Statistically insignificant factors were % silt, % organic matter, conductivity, surface area, exchangeable calcium, and total cation exchange capacity. (Cassar-FRC)
W81-01771

EFFECTS OF ADAPTATION ON BIODEGRADATION RATES IN SEDIMENT/WATER CORES FROM ESTUARINE AND FRESHWATER ENVIRONMENTS,
Environmental Research Lab., Gulf Breeze, FL.
J. C. Spain, P. H. Pritchard, and A. W. Bourquin.
Applied and Environmental Microbiology, Vol 40, No 4, p 726-734, October, 1980. 8 Fig, 2 Tab, 12 Ref.

Descriptors: *Microorganisms, *Biodegradation, Methyl parathion, p-Nitrophenol, Aquatic bacteria, Bacteria, *Sediments, Cores, Estuaries, Pesticides, Adaptation, Freshwater.

Adaptation among natural microbial populations exposed to methyl parathion (MP) and p-nitrophenol (PNP) was investigated. Specific attention was directed to the issue of whether adaptation could affect predictions of biodegradation rates for xenobiotics at low concentrations in the environment. A preliminary experiment was conducted to determine whether adaptation could be detected in mixed cultures by following mineralization. For this study, a number of ecocores were taken from the Escambia River sampling site, spiked with MP or PNP and analyzed. Both MP and PNP were mineralized much more rapidly in cores preexposed to the compounds at a concentration of 180 micromolar PNP. Cores that received lower concentrations of the parent compounds, 0.45 micromolar released carbon dioxide at a much lower overall rate. Differences in initial biomass concentrations at the sample sites did not account for differences in adaptation patterns. The addition of yeast extract to flasks containing samples from a specific site did not facilitate adaptation, indicating that nutrient limitations was not the deciding factor. Organisms able to degrade MP in pure culture were not isolated from either sampling site. The fact that preexposure to PNP increases the fraction of the population able to degrade PNP supports the idea that a particular segment of the population is selected by exposure to the nitrophenol. The ability of the microbial population to adapt and rapidly degrade a compound may be an additional rate-determining factor. (Baker-FRC)
W81-01772

CHEMICAL COMPOSITION OF RECENT BOTTOM SEDIMENTS OF THE LAKE ZAGNANIE,
Akademia Rolniczo-Techniczna, Olsztyn-Kortowo (Poland). Inst. of Hydrobiology and Water Conservation.
T. Januszkiewicz, and K. R. Januszkiewicz.
Acta Hydrobiologica, Vol 22, No 2, p 157-178, 1980. 6 Fig, 2 Tab, 34 Ref.

Descriptors: *Lake sediments, *Bottom sediments, *Lake Zagnanie(Poland), *Chemical analysis, Water pollution sources, Limnology, Eutrophication, Poland, Water pollution effects, Sewage, Organic matter, Calcium carbonate, Metals, Phosphates, Phosphorus compounds, Nitrogen compounds, Manganese, Farm wastes.

The upper layer (15 to 20 cm thick) of sediments at the bottom of Lake Zagnanie, Poland, was analyzed chemically as part of a study to determine whether pollutants from farms and sewage disposal were responsible for recent decreases in fish harvests. Among the many analyses performed were pH, water content, organic matter content, insolubles, ammonia nitrogen, total nitrogen, phosphates, total phosphorus, sulfates, total sulfur, silica, and several metal oxides. The major sediment components were calcium carbonate, silica, and organic matter. Anthropogenic sources were believed responsible for the higher levels of organic matter, sulfides, iron and manganese found near the mouth of an inlet river. Iron and aluminum act as floccu-

lants for Mn-phosphorus complexes that were found. (Cassar-FRC)
W81-01791

RURAL NONPOINT SOURCE WATER QUALITY IN A SOUTHEASTERN WATERSHED,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
F. J. Humenik, L. F. Bliven, M. R. Overcash, and F. Koehler.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 29-43, January, 1980. 6 Fig, 8 Tab, 13 Ref.

Descriptors: Streams, Watersheds(Basins), *Land use, *Water quality, *Rural areas, *Runoff, Nutrients, Soil chemistry, Seasonal, Channeling, *North Carolina.

An interpretation of rural stream water quality in the Chowan River basin is presented which is based on a two-year grab sampling program. Data analyses are summarized by sections which present overall basin data, comparisons between physiographic areas, relationships between water quality and land use, comparisons of channelized and nonchannelized stream water quality, analyses of seasonal fluctuations, and concentration versus water yield analysis. The four areas of the basin sampled had relatively constant mean nutrient concentrations. The greatest variation was seen between the piedmont and the coastal plain areas. This was thought to be due to natural variations in soil type, etc. There was no clear relationship between water quality and land use, but these results may be due to the limited number of sampling sites. Seasonal trend analysis indicated that nutrient loads were greater during the winter and spring, reflecting rainfall cycles. The effect of channelizing was pronounced with respect to the high NO3-N concentrations found in channelized streams. Nutrient concentrations showed no consistent relationship with flow. (Small-FRC)
W81-01804

CYANIDE PROBLEMS IN MUNICIPAL WASTE WATER TREATMENT PLANTS,
Metropolitan Sanitary District of Greater Chicago, IL. Development Div.
D. T. Lordi, C. Lue-Hing, S. W. Whitebloom, N. Kelada, and S. Dennison.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 597-609, March, 1980. 6 Fig, 8 Tab, 14 Ref.

Descriptors: *Toxins, *Municipal wastes, *Water quality standards, Illinois, Industrial wastes, Treatment facilities, Performance, Effluents, Toxicity, Minnows, *Cyanide.

The occurrence of cyanide, the distribution of cyanide species in waste water, and the control of cyanide are discussed. Cyanide levels in the Metropolitan Sanitary District of Greater Chicago (MSDGC) treatment plant effluents have been monitored daily since 1972. All of the plants had daily cyanide concentrations that at times exceeded 0.025 mg/liter, the Illinois Pollution Control Board's original effluent limit. The Calumet plant, which receives water from a highly industrialized area including five steel plants, had the highest cyanide levels, with an annual average of 0.095 mg/liter. The major portion of the cyanide was found to be in complex form (iron or cobalt cyanide complexes). The average cyanide removal rates by the industrialized plants were 0-91%. A series of 96-hour acute toxicity tests was performed using unchlorinated, nitrified and non-nitrified effluent from the plants on fatheaded minnows. There was no evidence of toxicity, probably because cyanide occurred in complexes of reduced toxicity. The new Illinois cyanide standard is 0.10 mg/liter of total cyanide as a monthly average and 0.20 mg/liter for any 24-hour period. (Small-FRC)
W81-01819

LONG-TERM EFFECTS OF IRRIGATION WITH WASTE WATER,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 3C.
W81-01823

IMPACT OF SEDIMENTS ON DISSOLVED OXYGEN CONCENTRATIONS FOLLOWING COMBINED SEWER OVERFLOWS,
Rexnord Inc., Milwaukee, WI. Environmental Research Center.
W. A. Kreutzberger, R. A. Race, T. L. Meinholz, M. Harper, and J. Ibach.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 192-201, January, 1980. 8 Fig, 4 Tab, 8 Ref.

Descriptors: *Dissolved oxygen, *Sediments, *Overflow, *Combined sewer overflows, Rivers, Water pollution sources, Scour, Temperature, Velocity, Wisconsin, *Milwaukee(WI), Milwaukee River.

The effect of combined sewer overflow on the Milwaukee river was investigated for the following three purposes: to demonstrate that sediments are the source of the large wet weather oxygen demand, to show that scouring by submerged combined sewer overflow outfalls is the mechanism by which this demand is exerted, and to develop a method of predicting the impact of sediment scouring on dissolved oxygen levels. This information can help in the development of realistic receiving water models. Field investigations monitored dissolved oxygen, temperature, disturbed and undisturbed sediments, and water velocity. Data were analyzed using multiple linear regression. Sediment oxygen demand rates indicated that the river is a significant sink for dissolved oxygen even in dry weather. Velocity measurements in the vicinity of combined sewer outfalls indicated that the scouring of sediments by discharges is the probable mechanism by which the sediments cause rapid drops in dissolved oxygen levels. Combined sewer overflow abatement is recommended. (Small-FRC)
W81-01843

RETENTION OF RADIONUCLIDES BY MOBILE HUMIC COMPOUNDS AND SOIL PARTICLES,
Washington State Univ., Pullman. Dept. of Chemical Engineering.
J. C. Sheppard, M. J. Campbell, T. Cheng, and J. A. Kittrick.
Environmental Science & Technology, Vol 14, No 11, p 1349-1353, November, 1980. 3 Fig, 3 Tab, 12 Ref.

Descriptors: *Adsorption, *Radioactive wastes, *Colloids, Humic acid, Fulvic acid, Nuclear wastes, *Path of pollutants, Soil types, Model studies, Soil water, Percolation, Particle size, Clays, Kaolinite, Cations, Separation techniques, Mathematical studies.

The transport of radionuclides in soils and groundwater may be facilitated by particles of colloidal dimensions. Five US soils (two silt loams, one sand, one loamy sand and a sandy clay loam) were analyzed for particulate and ionic distribution ratios in relation to the effects of the ionic species, humic and fulvic acid complexes of radionuclides and radionuclide-bearing soil colloids (clays). The distributions of radionuclides between the soil and aqueous phases were determined by characteristic spectra of radionuclide-bearing particles. Three broad classes of particles determined the distribution ratios of the soils studied: ionic (particles with radionuclides having radii less than 1 mm); complexes of humic matter, possibly humic acid polymers (2-3 mm radii); and larger soil particles bearing radionuclides with radii of 10-60 mm. Gel filtration studies revealed that humate complexes dominated the distribution ratios for the soil systems tested. Evidence is presented to show that much of the mobility of radionuclides in the soil-aquatic environment is due to soil particles in the 2-3 mm range. Sorption sites for radionuclides appear to be on the surface of the soil particles, with adsorption tendencies of the U, Cs, Sr, and Am cations varying with the charge density of the hydrated ions. Humic complexing of radionuclides tends to alter the migration equation commonly used for soil-aquatic systems and greatly complicates the modeling of radionuclide transport. (Geiger-FRC)
W81-01865

PRODUCTION OF UREA BY BACTERIAL DECOMPOSITION OF ORGANIC MATTER INCLUDING PHYTOPLANKTON,
Yamagata Univ. (Japan). Dept. of Chemistry.
Y. Satoh.
Internationale Revue Der Gesamten Hydrobiologie, Vol 65, No 2, p 295-301, 1980. 2 Fig, 2 Tab, 13 Ref.

Descriptors: *Urea, *Decomposing organic matter, *Bacteria, Water pollution sources, Eutrophication, Organic matter, Lakes, Nitrogen compounds, *Phytoplankton, Fragilaria crotonensis, Aquatic microorganisms, Japan, *Lake Suwa(Japan).

Urea was produced by aerobic bacterial decomposition of Fragilaria crotonensis, a dominant member of the phytoplankton community in water of Lake Suwa, Japan, and by decomposition of surface water organic matter from the same lake. Rate constants of urea production were 0.083 per day for F. crotonensis and 0.051 per day for the organic matter. Urea production reached a peak in the Fragilaria experiment at 5 weeks and then declined toward the eighth week, a possible result of urease activity. Urea levels in the surface organic matter experiment reached a peak at 4 weeks and did not drop. This study shows that urea may be produced in natural waters by decomposition of organic matter as well as by the well-known processes of excretion by aquatic animals and human pollution. (Cassar-FRC)
W81-01866

DIFFERENCE IN THE COMPOSITION OF LINEAR ALKYLBENZENE SULFONATE HOMOLOGUES IN RIVER SEDIMENT AND RIVER WATER,
Tokyo Metropolitan Univ. (Japan).
H. Hon-nami, and T. Hanya.
Japanese Journal of Limnology, Vol 41, No 1, p 1-4, January, 1980. 3 Fig, 2 Tab, 6 Ref.

Descriptors: *Rivers, *Alkylbenzene sulfonates, *Sediments, *Water pollution sources, Detergents, Japan, *Tama River(Japan), Organic compounds.

The composition of linear alkylbenzene sulfonate homologues in surface sediment and water of the Tama River showed unusual differences. In sediment the proportions of C12 and C13 were higher, and the C10 and C11 lower than those in the water. In fact, very little C10 appeared in the sediment. C14 was detected at 1.7% in only one sediment sample, none in water. Total alkylbenzene sulfonate concentrations in sediment were 50 to 500 times as high as in water. As the carbon number of the alkyl groups increased, the ratio of concentration of alkybenzene sulfonates in sediment to that in water increased exponentially. The authors explain this distribution of alkyl groups by stating that the longer the alkyl chain length, the more alkylbenzene sulfonates were adsorbed in the sediment. (Cassar-FRC)
W81-01875

TOXICITIES OF MICROCYSTIS AERUGINOSA COLLECTED FROM SOME LAKES, RESERVOIRS, PONDS AND MOAT IN TOKYO AND ADJACENT REGIONS,
Tokyo Metropolitan Research Lab. of Public Health (Japan).
For primary bibliographic entry see Field 5C.
W81-01876

CITY EXAMINES EFFECTS OF ROAD SALTING ON ITS WATER SUPPLY,
Massachusetts Dept. of Public Works, Worcester.
R. L. Moyland, Jr.
Public Works, Vol 111, No 8, p 59-60, August, 1980.

Descriptors: *Urban runoff, *Salt, *Reservoirs, Urban areas, Water quality, Deicers, Potable water, Sodium compounds, Winter, Highways, *Highway icing, Massachusetts.

The effect of winter salting on the water quality of Worcester, Massachusetts, and the locations where salt could be entering the water supply were investigated. Worcester's water supply is made up of ten surface reservoirs and two gravel packed wells located outside of or on the edge of the city. No runoff from within the city runs into the surface water supply. Roads near the reservoirs are salted and sanded, but sodium readings on the reservoirs indicate no salt contamination. Urban runoff does flow into the Lake Quinsigamond basin, where the one well in use is located. Sodium levels in the well are 26 mg/liter, a moderate level for groundwater. Runoff which flows into the Blackstone River does not enter Worcester's or any other city's drinking supply. The Worcester Department of Public Works has limited the use of salt to streets which are critical to moving traffic through the city. Residential streets are excluded. Uniform application is achieved through the use of automatic spreaders, and salt supplies are kept covered and secured. The department recommends the continued use of road salt. (Small-FRC)
W81-01878

PREDICTION OF THE VOLATILIZATION RATES OF HIGH-VOLATILITY CHEMICALS FROM NATURAL WATER BODIES,
SRI International, Menlo Park, CA.
J. H. Smith, D. C. Bomberger, Jr., and D. L. Haynes.
Environmental Science & Technology, Vol 14, No 11, p 1332-1337, November, 1980. 4 Fig, 4 Tab, 31 Ref.

Descriptors: *Path of pollutants, *Volatilization, *Evaporation, *Atmospheric water, Organic compounds, Water pollution, Water pollution sources, Equations, Mathematical studies, Waste water treatment, Natural streams, Surfactants, Diffusion.

The transport of pollutants from water bodies to the atmosphere by volatilization or evaporation may be an important environmental fate pathway for many chemicals. A simple laboratory procedure which has been used to obtain volatilization rate data for benzene and several chlorinated hydrocarbons is described. The method measures the ratio of the evaporation rate constant of the pollutant to the oxygen reaeration rate constant. This ratio has been shown to be constant for volatile compounds subjected to a wide range of conditions. If the oxygen reaeration rate constant can be estimated or measured in a waste water treatment system or in a natural water body, then the volatilization rate constant of the compound under those same conditions may be calculated by multiplying the value of the ratio by the environmental value of the oxygen reaeration rate constant. The effects of diffusion surfaces and surfactants are also considered. Results indicated that many low-molecular-weight, nonpolar compounds will undergo volatilization as their major environmental fate pathway. (Geiger-FRC)
W81-01899

5C. Effects Of Pollution

AN EVALUATION OF LIME TREATMENT AND SAND DRYING BEDS FOR UPGRADING STABILIZATION POND EFFLUENT,
Dept. of Civil Engineering. Mississippi State Univ., Mississippi State.
J. R. Taylor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-167223, Price codes: A11 in paper copy, A01 in microfiche. MS Thesis, August 1980. 229 p, 46 Fig, 26 Tab, 44 Ref, 8 Append. OWRT-A-110-MISS(2), 14-34-0001-8026.

Descriptors: *Cyanophyta, *Salt marshes, Biological communities, Ecological distribution, Light intensity, Bulrush, Mississippi, Biogeography, *Algal control, Sludge treatment, *Lime treatment, Ponds, Effluents, Dewatering, Drying, Sand drying beds, *Edaphic algae, *Graveline Bay Marsh(MS), Schizothrix, Spartina, Juncus, Distichlis.

Removal of algae from stabilization pond effluents is required for the effluent to meet current federal discharge standards. Application of a thickened lime-algae sludge to sand drying beds was investigated as a treatment method. The sludge was loaded at rates of 4.0 to 16.1 gal/sq ft to sand bed columns with media depths of 6 to 12 inches. A sludge cake with an average 25% solids content was obtained within ten hours at bed depths of 6 to 10 inches over the loadings applied, while 65 hours were required for a bed depth of 12 inches at loadings above 12 gal/sq ft. Investigations indicated that dewatering rate and effluent quality were not related to media size from 0.3 to 1.5 mm. Dewatering rates decreased with increasing solids loading from about 1 to 6 lbs/sq ft; however, effluent quality and sludge cake solids depended more on sludge mat formation than on loading. Dewatering rates above 1 gal/sq ft per hr were noted at a bed depth of 10 inches. Effluent suspended solids from the drying beds averaged about 80 mg/l. Supernate withdrawal was effective only when high sludge loadings and/or deep bed depths caused filter binding. In addition, the supernate averaged 175 mg/l of total suspended solids, which would require recirculation to the lagoon.
W81-01653

CADMIUM IN FOREST ECOSYSTEMS,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
W. E. Sopper, and S. N. Kerr.
In: Cadmium in the Environment, Pt I, J. O. Nriagu (Ed), John Wiley & Sons, Inc., 1980, Ch 17, p 655-667, 7 Tab, 18 Ref. OWRT-B-083-PA(3), 14-34-0001-5109.

Descriptors: *Cadmium, *Ecosystems, *Vegetation, Metals, Public health, Toxicity, Trees, Irrigation, Soils, Effluents, Cation exchange, Waste water disposal, Irrigation, Water pollution effects, *Forests, *Wastewater quality, Gamelands, Metal concentrations.

Data have been presented showing levels of cadmium in forest vegetation and soils subjected to wastewater irrigation for 16 years. In the old field areas white spruce, goldenrod, and wild strawberry showed no increase in cadmium levels due to wastewater irrigation. Cadmium concentrations in all species were lower in the wastewater-irrigated area than in the control area because of the greater biomass production resulting from the irrigation. This provides evidence that under low cadmium applications in a wastewater disposal system the actual cadmium concentration of some herbaceous vegetation may be decreased. None of the species sampled in the old gamelands area showed a significant increase in cadmium levels as a result of the wastewater irrigation. Soil cadmium status was not significantly affected by wastewater irrigation in either area, except for the increase in cadmium concentration at the 0 to 5 cm depth in the irrigated old gamelands area. Cadmium levels decreased with depth in the soil profile in both treated and control areas. On the basis of information currently available it appears that the introduction of cadmium into forest ecosystems as an indirect result of industrial pollution or through the planned application of municipal wastewater and sludge will have a minimal effect.
W81-01654

MAXIMUM UTILIZATION OF WATER RESOURCES IN A PLANNED COMMUNITY; EUTROPHICATION POTENTIAL OF SURFACE WATERS IN A DEVELOPING WATERSHED,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
C. H. Ward, and J. M. King.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-107138, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-127, August, 1980. 97 p, 29 Fig, 22 Tab, 19 Ref, 1 Append. 802433.

Descriptors: *Eutrophication, *Urbanization, *Algae, *Water pollution, Texas, Water resources development, Stormwater, Low flow, Soil algae, Phosphorus, Nitrogen, Nutrients, Aquatic algae, Community development, Surface drainage, Soil chemistry, Leachate, *Community development, Planned community.

The algal populations in The Woodlands, Texas, were characterized to evaluate the impact of urbanization on the aquatic flora. Several aquatic habitats were sampled on a regular basis to identify factors which influence algal population dynamics. Nutrient limitation studies were conducted to determine which nutrient was most limiting for algal growth during conditions of low flow and stormwater runoff. Water from Hunting Bayou and Westbury Square, developed communities near Houston, Texas, were used in bioassay experiments. The impact of urbanization on edaphic algal populations was also determined. Nutrient limitation studies in Panther Branch and the Conference Center Lakes showed that phosphorus additions to low-flow water increased algal cell yields, while yields in stormwater samples were increased by nitrogen additions. Undisturbed soils had more diverse algal populations, but smaller standing crops, than disturbed soils, even though concentrations of nitrogen and phosphorus were higher than in most disturbed soils. Soil disturbance caused development of a more diverse blue-green algal flora, probably due to accompanying increases in soil pH. Bioassays showed that phosphorus was the nutrient most limiting for algal growth in water leachates of soils. (Moore-SRC)
W81-01685

WATER QUALITY AND BIOLOGICAL EFFECTS OF URBAN RUNOFF ON COYOTE CREEK; PHASE I - PRELIMINARY SURVEY,
Woodward-Clyde Consultants, San Francisco, CA.
R. Pitt, and M. Bozeman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-144487, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-104, August 1980. 81 p, 9 Fig, 35 Tab, 20 Ref, 1 Append. R805418.

Descriptors: *Urban runoff, *Water quality, *Water pollution, *Aquatic life, California, Sediments, Water chemistry, *Environmental effects, Lead, Zinc, Fish, Aquatic algae, Aquatic plants, Invertebrates, Streamflow, Roads, Surface runoff, Nitrites, Ammonia, Sulfates, Silts, San Jose(CA), Coyote Creek(CA).

An evaluation of the receiving water effects of urban runoff is necessary before urban runoff control goals and practices can be established and selected. Coyote Creek, near San Jose, California, receives minimal pollutant discharges, upstream and in the study area, except for urban runoff. The parameters generally analyzed at each sampling station include: fish; benthic organisms; attached algae; rooted aquatic vegetation; sediment size distribution; sediment chemistry; biological tissue analyses for lead and zinc. Receiving water chemistry, runoff water chemistry and yields, and hydrology were also studied for Coyote Creek. Sources of urban runoff pollutants are being investigated and include sampling from source areas such as street surfaces, parking areas, landscaped areas and rooftops. A marked increase in nitrites, ammonia, turbidity, chlorides and specific conductance was found as the creek passed through the urbanized area of the watershed. Sediment samples from urban areas contained higher concentrations of many of the parameters as compared to the non-urban samples. Sulfates, lead, and orthophosphates were notable examples. Much more silt was also found in the urban samples, signifying a greater discharge of finer sediments from the urban area. Lead concentrations in urban samples of algae, crayfish and cattails were 2 to 3 times greater than in non-urban samples, while zinc concentrations were 3 times the non-urban sample concentrations. The non-urbanized section of the creek supports a comparatively diverse assemblage of aquatic organisms including at least 12 species of fish and various benthic macroinvertebrate taxa. The urbanized portion of the stream supports an aquatic community that is generally lacking in diversity

and is dominated by pollution tolerant fish and benthic invertebrates. (Moore-SRC)
W81-01687

HANDLING OF COMBUSTION AND EMISSION-ABATEMENT WASTES FROM COAL-FIRED POWER PLANTS: IMPLICATIONS FOR FISH AND WILDLIFE RESOURCES,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
L. F. Soholt, R. W. Vocke, N. J. Beskid, W. K. Derickson, and M. J. Knight.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-158917, Price codes: A09 in paper copy, A01 in microfiche. Fish and Wildlife Service, Office of Biological Services, National Power Plant Team Report FWS/OBS-80/33, September, 1980. 184 p, 25 Fig, 51 Tab, 333 Ref, 3 Append.

Descriptors: *Wildlife, *Waste disposal, *Powerplants, *Environmental effects, Landfills, Sludge disposal, Revegetation, Water pollution sources, Trace elements, Solid wastes, Fly ash, Toxic substances, Power plant aggregate, Flue gases, Coal, Energy, Effects.

The goals of this report are to: provide a basic introduction to handling of wastes from coal combustion and emission abatement; and present a procedure for evaluating the potential for these wastes to impact fish and wildlife resources. Coal combustion ashes and flue-gas-desulfurization (FGD) sludges, the solid waste products from coal-fired facilities, contain a number of trace elements that can be toxic to biota if they are available in sufficient quantities. Both ashes and FGD sludges are usually deposited in pond or landfill storage areas. Dispersal of constituents from waste-storage sites occurs primarily by runoff, seepage, and wind erosion. Generally, pond storage methods, even when properly managed, have a greater impact upon fish and wildlife resources than do landfill methods. Proper management of storage sites reduces the amount of waste constituents that are dispersed into the environment. The potential for uptake of trace elements to toxic levels is dependent upon a number of factors including: pH of the dispersal and growth media; capacity of the dispersal and growth media to bind elements in a form unavailable for uptake; magnitude of biological concentration of elements in primary producers and succeeding trophic levels; and tolerances of individual species. After the active lifetime of a waste-storage site, revegetation is desirable as a means of controlling erosion and regaining potential fish and wildlife habitat. Four model waste-storage sites are used to illustrate the methods of assessment presented in this report. (Moore-SRC)
W81-01688

TRANSMISSION OF VARIOUS SALMONELLAE AMONG FISH (CRASSIUS AUTATUS) IN THE AQUATIC ENVIRONMENT,
Purdue Univ., Lafayette, IN.
R. L. Lawton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173767, Price codes: A04 in paper copy, A01 in microfiche. Master of Science Thesis, 1979. 56 p, 2 Fig, 10 Tab, 54 Ref. OWRT B-076-IND(9).

Descriptors: *Salmonella, *Aerobic bacteria, *Aquatic environment, *Fish, Water pollution, Eutrophication, Effects, Bottom sediments, *Fish diseases, Infection.

The infection rates of various Salmonella serotypes for goldfish (C. auratus) were evaluated under a number of controlled environmental conditions. Studies were undertaken to determine the number of salmonellae necessary to cause infection, and to elucidate the conditions instrumental to the pathogen's continued persistence in the aquatic environment. All 32 strains (representing 12 serotypes of Salmonella) studied were shown to infect C. auratus. Under appropriate physiological conditions, the fish were infected for a period of two weeks with less than one organism/ml water (based on MPN analysis). Physiological stress to the fish augmented infection rates. Increased eutrophy was correlated with lowered infection rates and decreased survival of the pathogen. The presence of a bottom sediment under these same eutrophic conditions produced infections of six weeks duration. Isolation of salmonellae from the gastrointestinal tracts of the fish suggested that colonization of the fish viscera occurred in these experiments. A cycle of reinfection, i.e. fish to water to fish, could have taken place. The presence of fish constituted an important element for the survival of Salmonella in freshwater.
W81-01692

ENVIRONMENTAL CONTROL OF PITHOPHORA OEDOGONIA (CHLOROPHYCEAE) AKINETE GERMINATION,
Purdue Univ., Lafayette, IN. Dept. of Botany and Plant Pathology.
D. F. Spencer, T. R. Volpp, and C. A. Lembi.
Journal of Phycology, Vol 16, p 424-427, 1980. 3 Fig, 3 Tab, 16 Ref. OWRT B-081-IND(3).

Descriptors: *Algae, *Cladophora, *Germination, *Environmental control, Akinete, Lakes, *Indiana, Cladophorales, Filamentous, Green algae, Life cycles, Pithophora, Spores, Nutrients, Temperature, *Surrey Lake(IN).

Abundance of Pithophora oedogonia akinetes displayed seasonal changes, being greatest in winter and lowest in summer. Akinete abundance showed significant ($P<0.001$) negative correlations with photoperiod ($r = -0.53$) and water temperature ($r = -0.75$) during the period February 1978 through June 1979. Experiments in which akinete germination was studied in response to manipulations of nutrients (NO sub 3 -N and PO sub 4 -P), photoperiod and temperature indicated that temperature was the primary factor regulating the timing of the vernal flush of akinete germination observed in Surrey Lake.
W81-01699

EPIFAUNAL INVERTEBRATES AS MONITORS OF WATER QUALITY IN LAKE PONTCHARTRAIN,
New Orleans Univ., LA. Dept. of Biological Sciences.
M. A. Poirrier.
In: Proceedings, Third Coastal Marsh and Estuary Management Symposium. p 105-111. Louisiana State University Division of Continuing Education, Baton Rouge, LA, 1979. J.W. Day, Jr., D.D. Culley, Jr., R.E. Turner, and A.J. Mumphrey, Jr., eds. OWRT-A-041-LA(2).

Descriptors: *Water pollution effects, *Aquatic life, *Lakes, Louisiana, New Orleans(LA), *Lake Pontchartrain(LA), Physicochemical properties, Chemical analysis, Bioindicators, Invertebrates, Pollutant identification, Water quality, Estuarine environment.

The distribution and abundance of epifaunal invertebrates was investigated as a means of assessing and monitoring the impact of adverse water quality upon aquatic life. Species zonation along pollution and salinity gradients in Lake Pontchartrain was studied. Many species occurred in zones along these gradients, indicating a relationship between water quality and distribution, and hence, potential as indicator species. Computer principal components and discriminant functions analyses were used to establish species groups and to compare the distribution of these groups with water quality paramenters. As in other studies, the number of species decreased along pollution gradients and highly polluted habitats were dominated by tolerant, opportunistic forms. Salinity was found to be the factor most highly correlated with species distribution. Several species appeared to be good salinity indicators because of changes in abundance and morphology along salinity gradients. Taxonomic and life history studies were conducted and numerous new distributional records established. Studies on the impact of the 1973 and 1975 Bonnet Carre Spillway opening were also conducted.
W81-01700

VIEWS OF A PROMINENT CONSERVATIONIST,
Victoria Univ. (British Columbia).
R. Haig-Brown.
In: Pollution and the Fisheries: Proceedings 27th Annual Meeting of the Fisheries Council of Canada, Environmental Protection Service Report No EPS-3-WP-73-4, August, 1973, p 3-12.

Descriptors: *Water pollution effects, Water quality, Oceans, *International waters, *Commerical fishing, *Aquatic life, *Conservation, Effects, Fishkill, Radioactivity effects, Toxicity, Water pollution, Water quality control, International waters, Bodies of water, Estuaries, Lagoons, Marine fisheries, Pesticides drift, Oil spills, Water pollution sources, Wastes, Chemical wastes, Fish toxins, Fish populations.

Water pollution in world-wide terms was discussed, including some assessment of the risks of degrading the oceans themselves. The risk and possibility of degrading the oceans and largely destroying their present potential values is very real without some change in present trends. Broad-scale pollution already exists through fallout of pesticides and nuclear and industrial wastes. To illustrate, Russia has reported significant levels of strontium-90 in pelagic fish eggs in the Black Sea. Long-lived pollutants (pesticides, radioactive substances) can disperse over thousands of miles, and eventually through the entire general system of the ocean. Ocean transportation of oil and deep sea mining represent additional threats. Pollution in rivers, river estuaries, lagoons, saltmarshes, shallow seas, and out over the continental shelf, compound the problems. In a major Canadian estuary (the Fraser), one of the world's greatest salmon producers, daily loadings of 129 million gallons of chlorinated sewage are proposed. Vigilance on the part of coastal States, as well as international guidance and standards are needed. It was concluded that, should pollution continue at its present rate, the best estimate of continuing ocean life is between 50-100 years. (Zielinski-IPA)
W81-01704

GOVERNMENT PHILOSOPHY AND ACTIVITIES,
P. M. Higgins.
In: Pollution and the Fisheries: Proceedings, 27th Annual Meeting of the Fisheries Council of Canada, Environmental Protection Service Report No EPS-3-WP-73-4, August, 1973, p 13-21.

Descriptors: *Water pollution control, *Water law, *Canada, *Fisheries, *Fish toxins, Pollution abatement, Planning, Legal aspects, Administrative decisions, Constitutional law, Legislation, Water policy, Water quality, Water quality control, Water pollution sources, Water pollution, Foreign countries, Geographical regions, Regions, North America, Governments.

The Canadian Federal Fisheries Act, one of the first Acts of Parliament, was recently amended to significantly strengthen pollution control provisions. Section 33, subsection 12, provides that 'the Governor in Council may make regulations prescribing: (1) substances and classes of substances; (2) quantities, or concentrations of substances; (3) treatments, processes and changes of water.' Pollution control program alternatives and development of regulations were discussed. It was concluded that the effluent regulations for fish processing plants being developed under Section 33 of the Fisheries Act will contain a number of important ingredients: (1) maximum requirements for uniform national application that may be superseded by more stringent local requirements where appropriate; (2) incorporation of practical (economic/technologic) recycling/recovery technology expressed in terms of permissible limits of substances (quantity/production units); (3) development by joint Federal/provincial/industry liaison and reviewed individually with Provincial Pollution Control Agencies; (4) initial immediate application to all new installations and by individually-negotiated time schedules for existing facilities; and (5) dynamically reflect the state of pollution control technology through periodic review. (Zielinski-IPA)
W81-01705

HEALTH CONSIDERATIONS IN THE PREPARATION OF DRINKING WATER FROM THE RIVER RHINE,
Kiwa Ltd., Rijswijk (Netherlands).
C. Poels.
Water SA, Vol 6, No 1, p 15-20, January, 1980. 2 Fig, 4 Tab, 9 Ref.

Descriptors: *Potable water, *Toxins, *Fish physiology, Aromatic compounds, Water pollution, Public health, Water quality, Fish, Rivers, *Rhine River(Netherlands).

The suitability of Rhine water for the preparation of drinking water was examined in four experiments. Experiment A determined the chronic toxic quality of Rhine water and its effects on rainbow trout. Experiment B determined that the mortality of rainbow trout eggs was higher in Rhine water, and that the water was acutely toxic to juvenile trout. Experiment C, on the induction of cytogenetic effects of Rhine water in fish, found evidence that strongly suggests the Rhine water contained substances which were able to induce chromosome breaks in the gills of the eastern mudminnow. Experiment D. on the induction of mutations in bacteria by Rhine water, found that aromatic hydrocarbon fractions increased the number of mutations. The significance of these results to the preparation of Rhine water for drinking by humans is not yet known. (Small-FRC)
W81-01753

MARINE SOFT-BOTTOM BENTHIC COMMUNITY OFFSHORE FROM BLACK ROCK SEWAGE OUTFALL, CONNEWARRE, VICTORIA,
Melbourne University, Parkville (Australia), Dept. of Zoology.
J. H. Dorsey, and R. N. Synnot.
Australian Journal of Marine and Freshwater Research, Vol 31, No 2, p 155-162, April, 1980.

Descriptors: *Crustaceans, *Benthic fauna, *Outfall sewers, Water pollution effects, Outlets, Black Rock Outfall, Polychaetes, Aquatic life, Marine animals, Nitrates, Phosphates, Nutrients, Sewage, Algae, Sediments, Plankton, Amphipoda, Victoria, Australia.

Crustaceans and polychaetes dominated the infaunal species in the offshore benthic community at Black Rock Sewage Outfall, Victoria, Australia. These animals have also been seen in high counts at a sewage drain in the Port Phillip Bay area. Sewage contributes both organic particulates and nutrients that stimulate the growth of benthic unicellular algae. These materials plus plankton are a suitable food supply for the observed animals, which are detritus and suspension feeders. The habitat is basically uniform, fine-grained, sandy sediment which generally supports fewer species than a less homogeneous sediment. (Cassar-FRC)
W81-01778

RAPID INDUCTION OF COPPER-BINDING PROTEINS IN THE GILLS OF METAL EXPOSED MUSSELS,
Genoa Univ. (Italy). Ist. di Fisiologia Generale.
A. Viarengo, M. Pertica, G. Mancinelli, G. Zanicchi, and M. Orunesu.
Comparative Biochemistry and Physiology C, Vol 67, No 2, p 215-218, 1980. 4 Fig, 14 Ref.

Descriptors: *Mussels, *Copper, *Water pollution effects, Gills, *Proteins, Trace elements, Metals, Toxicity, Metallothioneins, Aquatic animals.

Mussels synthesized low molecular weight (12,000) soluble copper-binding proteins similar to metallothioneins in gill tissue as a response to sublethal copper concentrations (0.08 ppm) for 24 to 48 hours. Evidence that these proteins are neosynthesized was obtained by injecting S35 labeled systeine into the posterior adductor muscle 7 hours before death in a 48 hour exposure. Compared with controls, cystein incorporation into the 12,000 molecular weight copper-rich fraction was 7 to 10 times greater, whereas it decreased in the high molecular weight soluble proteins. In addition, the sulfhydryl group concentration in these proteins was increased by 5 or 6 fold compared with controls. (Cassar-FRC)
W81-01785

CHIRONOMIDAE COMMUNITIES OF THE RIVER NIDA AND ITS TRIBUTARIES,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
K. Srokosz.
Acta Hydrobiologica, Vol 22, No 2, p 191-215, 1980. 10 Fig, 5 Tab, 83 Ref.

Descriptors: *Nida River(Poland), *Diptera, *Dominant species, *Water pollution effects, *Rivers, *Biological communities, Aquatic animals, Aquatic insects, Poland, Tributaries, Self-purification, Water purification, Habitats, Aquatic habitats.

The distribution and structure of Chironomidae communities in the River Nida (Poland) and its tributaries was studied on 17 dates at 11 stations during 1973-1975. Municipal and industrial wastes in the middle sector of the river system decreased the number of specimens and disturbed the domination structure. Tubificidae prevailed in polluted waters, while Naididae occurred in pure waters. At some stations in the polluted section a domination structure did not develop at all. As self-purification improved conditions downstream, domination structuures again appeared. In all, 148 taxonomic units were identified. (Cassar-FRC)
W81-01790

CHEMICAL COMPOSITION OF RECENT BOTTOM SEDIMENTS OF THE LAKE ZAGNANIE,
Akademia Rolniczo-Techniczna, Olsztyn-Kortowo (Poland). Inst. of Hydrobiology and Water Conservation.
For primary bibliographic entry see Field 5B.
W81-01791

INFLUENCE OF A SUBMARINE MUNICIPAL OUTFALL ON SURROUNDING BENTHIC ECOSYSTEM (PROCCHIO, ISLE OF ELBA, ITALY),
Genoa Univ. (Italy). Inst. di Anatomia Comparata.
R. Cattaneo, G. Polleri, and P. Pericoli.
Progress in Water Technology, Vol 12, No 1, p 163-184, 1980. 5 Fig, 3 Tab, 13 Ref.

Descriptors: *Outfall sewers, *Benthic fauna, *Sewage, *Bioindicators, *Bays, Ecosystems, Sedimentology, Water pollution effects, Aquatic life, Europe, Isle of Elba, Italy.

The distribution of the Bryozoa population (Cheilistomata) in a bed of posidonia along the coast of the Isle of Elba close to a small sewage outfall was studied. During the two years of the study, random samples were taken from the leaves and rhizomes of Posidonia oceanica, and the sediments under the beds were evaluated by oxidation with H2O2. The bryozoological populations in the posidonia beds were stable over the study period. An attempt was made to relate the type of fauna with the type of sediment, but without useful results. Two years of a small sewage discharge was not sufficient to alter the ecology of the bay. The research did reveal the complexity of the benthic ecosystem. Seventeen Anasca and 29 Ascophora were found. Also, within the bed there were two different populations, corresponding to the deepest and shallowest areas, both for the bryozoa present on the rhizomes and for those on the leaves. (Small-FRC)
W81-01803

LIMING ACID LAKES IN SWEDEN,
National Board of Fisheries, Goeteborg (Sweden).
For primary bibliographic entry see Field 5G.
W81-01814

TOXICITY OF LANDFILL LEACHATES,
Babichuk Construction Ltd., Calgary (Alberta).
R. D. Cameron, and F. A. Koch.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 760-769, April, 1980. 5 Fig, 7 Tab, 14 Ref.

Descriptors: *Toxins, *Leachate, *Landfills, Bioassay, Rainbow trout, Water analysis, Filtration, Coagulation, Lime, Ammonia, Copper, Hydrogen ion concentration, Toxicity.

Landfill leachate toxicity was reviewed by examining the results of several studies on natural leachates and synthetic leachates. Most toxicity analyses were conducted at independent testing laboratories using either the standard static 96-hour bioassay or the residual oxygen bioassay technique. Rainbow trout were the test organism in all experiments. Leachate toxicity varied over a wide range: from less than 16% to 100%. When leachates were treated by filtration through columns of natural peat or by lime coagulation followed by peat filtration, leachates were non-toxic. Most pollutants were reduced 85 to 99% by the two treatment processes. Over 94% of the observed toxicity was explained by un-ionized ammonia, tannin, copper, and hydrogen ion concentration. All natural leachates tested were found to be highly toxic within the confines of the landfill and usually after stream discharge. (Small-FRC)
W81-01828

EFFECTS OF HEATED EFFLUENT ON THE REPRODUCTIVE BIOLOGY OF WHITE CRAPPIE, POMOXIS ANNULARIS IN CONOWINGO POND, PENNSYLVANIA,
Radiation Management Corp., Drumore, PA. Muddy Run Ecological Lab.
D. Mathur, and P. L. McCreight.
Archiv fur Hydrobiologie, Vol 88, No 4, p 491-499, June, 1980. 2 Fig, 12 Ref.

Descriptors: *Nuclear powerplants, *Thermal pollution, *Fish reproduction, *Sunfishes, Gonads, Spawning, On-site investigations, Ponds, Pennsylvania.

The effects of heated effluent from the Peach Bottom Atomic Power Station on the reproductive biology of fishes, including altered spawning time and abnormal development and hatching of eggs, were examined. The water temperature in the plume averaged 5.6 to 11.1 degrees C above the ambient temperature. There was some variation in the gonosomatic index of fish, but the reproductive cycle remained similar to other years. Other researches have found some indication of interruption and biomodality in spawning of fish exposed to heated waters. In this study there was no evidence of earlier spawning in the thermal plume, using gonosomatic ratios and larval fish catches as indicators. Temperature at peak spawning was similar to other years and other areas. The gonosomatic ratios of crappie collected in the thermal plume were slightly lower than those from ambient areas. The gonosomatic ratio equals the weight of the ovaries divided by the weight of the fish minus the weight of the ovaries, times 100. (Small-FRC)
W81-01833

PARAMETRIC ANALYSES OF MORTALITY RATES IN BIOASSAYS,
Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Delft (Netherlands).
S. A. L. M. Kooijman.
Water Research, Vol 15, No 1, p 107-119, January, 1981. 7 Fig, 12 Tab, 15 Ref.

Descriptors: Mathematical models, *Bioassay, Toxicity, *Mortality, Toxins, Water pollution, Water pollution effects, Model studies, *Aquatic life, Sampling, Metabolism, Pesticide residues, Theoretical analysis.

Some parametric analyses of results of several bioassays in which several groups of organisms are exposed to a range of concentrations of test compounds are described. The main application of the analyses is in aquatic toxicity tests, although they sometimes may be useful in mammalian toxicology studies. The theory presented is based on the principle of maximum likelihood, and the concentrations of toxins are chosen so that at least one group

of organisms suffers significant but not excessive mortality. A large sample technique is employed to mathematically estimate the no effect level, the small effect level and the ultimate effect level of the test compound. The relevance of LC50 values in toxicity tests and hazard evaluations is considered. Procedures for the determination of accumulation and elimination behavior of test compounds through mortality information are given. A method is outlined for calculating the disappearance rate of a test compound in a semistatic bioassay from the mortality rates of the test species. The theory has been applied to toxicity tests on various aquatic species using cupric chloride, cadmium chloride, pentachlorophenol, 1,2,3-trichloropropane, para-chlorophenol and an industrial waste (DSB) as aquatic pollutants. (Geiger-FRC)
W81-01861

PRODUCTION OF UREA BY BACTERIAL DECOMPOSITION OF ORGANIC MATTER INCLUDING PHYTOPLANKTON,
Yamagata Univ. (Japan). Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W81-01866

A FISH-KILL IN HEART LAKE, ONTARIO, ASSOCIATED WITH THE COLLAPSE OF A MASSIVE POPULATION OF CERATIUM HIRUNDINELLA (DINOPHYCEAE),
Ontario Ministry of the Environment, Rexdale. Limnology and Toxicity Section.
K. H. Nicholls, W. Kennedy, and C. Hammett.
Freshwater Biology, Vol 10, No 6, p 553-561, December, 1980. 4 Fig, 28 Ref.

Descriptors: *Fishkill, *Destratification, *Water pollution effects, *Eutrophication, Ceratium hirundinella, Dinoflagellates, *Heart Lake(Ontario), Anaerobic conditions, Fish harvest, Aeration, Stratification, Aquatic algae, Recreation, Chlorophyta, Phytoplankton, Dissolved oxygen, Lakes, Limnology, Zooplankton, Canada.

During early August, 1976, a population of the dinoflagellate, Ceratium hirundinella, grew to a maximum level of 53 cu mm per liter in waters of Heart Lake, Ontario, a recreational lake which experienced blooms of blue-green algae. The lake has a history of enrichment from nearby duck farms. Artificial destratification by aeration was done for about 6 months beginning in June 1975 and again starting in April 1976. This process effectively inhibited algal bloom, but promoted oxidation and mineralization of organic matter on the lake bottom, raising levels of total phosphorus, soluble phosphorus, and organic nitrogen. These nutrients, the lack of competition from other algae, and the absence of organisms to feed on these larger cells permitted the dinoflagellates to grow rapidly. The biomass collapsed suddenly, causing oxygen depletion and killing more than 600 fish--rainbow trout, black bass, and bullheads. It is believed that inorganic nitrogen depletion started the collapse, which accelerated rapidly as decomposing cells depleted dissolved oxygen. (Cassar-FRC)
W81-01868

ABNORMALITIES IN THE TRACHEAL GILLS OF AQUATIC INSECTS COLLECTED FROM STREAMS RECEIVING CHLORINATED OR CRUDE OIL WASTES,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
K. W. Simpson.
Freshwater Biology, Vol 10, No 6, p 581-583, December, 1980. 1 Fig, 18 Ref.

Descriptors: *Aquatic insects, *Water pollution effects, *Oil pollution, Chlorine, Gills, Stoneflies, Caddisflies, New York, Allegheny River(New York), Gooseberry Creek(New York), Treatment facilities, Streams.

Aquatic insects collected in two streams in New York State showed tracheal gill alterations. At Gooseberry Creek, downstream from a treatment plant discharging chlorinated effluent, branches were absent or incomplete in gills in stonefly nymphs. Caddisfly larvae were greatly reduced in number, and 10 of 12 specimens had damaged gills. Sampling in the Allegheny River, which has a history of crude oil contamination, yielded 18 out of 40 caddisfly specimens with tar specks on their gills and 6 with completely tarred gills. All damaged specimens were smaller than normal and were living in water with high dissolved oxygen concentration. It is not known whether these individuals could have successfully completed their life cycles. Tracheal gill changes may be useful for documenting effects of toxic materials on freshwater fauna. (Cassar-FRC)
W81-01869

INORGANIC PHOSPHATE UPTAKE IN A BRACKISH TROPICAL LAGOON,
Office de la Recherche Scientifique et Technique Outre-Mer, Abidjan (Ivory Coast). Centre de Recherches Oceanographiques.
L. Lemasson, J. Pages, and J-L. Cremoux.
Estuarine and Coastal Marine Science, Vol 11, No 5, p 547-561, November, 1980. 9 Fig, 3 Tab, 41 Ref.

Descriptors: *Phosphates, *Ebrie Lagoon(Ivory Coast-Africa), *Nutrients, *Absorption, Aquatic microorganisms, Light intensity, Brackish water, Phosphorus compounds, *Lagoons, Ivory Coast(Africa), Bacteria, Phytoplankton, Aquatic environment, Photosynthesis, Seston, Water pollution effects, Sewage, Tropical regions.

The effect of light on phosphate uptake by aquatic microorganisms was studied in Ebrie Lagoon, Ivory Coast, West Africa. This body of water, about 550 sq km in area and with a mean depth of 3 meters, experiences tidal intrustions and sewage discharges from a city of 1 million. Phosphate uptake varied at the different stations sampled, but was classified into 3 general groups: light uptake differed from dark uptake and followed light variations; uptake was stimulated by light, but did not follow its variations; and light uptake equaled dark uptake. Phosphate uptake showed a 24 hour rhythm, with the highest uptake in the early morning and the lowest in the late afternoon. The maximum phosphate uptake rate was independent of light intensity when light energy was higher than a limit value. Phosphate uptake appeared to depend on the depletion of dissolved inorganic phosphate and on the ATP concentration in the seston. Two examples of luxury uptake of carbon were observed in a nutrient depleted station, and 1 case of luxury phosphate uptake was seen during phosphate excess. (Cassar-FRC)
W81-01871

ON THE BENTHIC FAUNA OF SOME RIVER SYSTEMS IN NAGASAKI DISTRICT (4). THE SASU AND THE SE RIVERS OF TSUSHIMA IN SUMMER (IN JAPANESE),
Nagasaki Prefecture Inst. of Health Science and Environmental Science (Japan).
S. Ishizaki, and Y. Machida.
Japanese Journal of Limnology, Vol 41, No 1, p 19-23, January, 1980. 3 Tab, 11 Ref.

Descriptors: *Mine wastes, *Water pollution effects, *Benthic fauna, *Mayflies, Diptera, Metals, *Nagasaki, Japan, Se River(Japan), Sasu River(Japan), Zinc, Aquatic life, Heavy metals, Rivers, Seasonal.

Discharge from a zinc mine affected the benthic fauna in the Sasu River in winter. In summer, numbers of individuals and species increased, the heavy metals content of the water increased, and the heavy metals in the mud decreased. Predominant fauna were Ephemeroptera in summer and Chironomidae in winter. In the Se River, the dominant species in winter and summer were the reverse of those in the Sasu River. All sampling stations showed rich animal life in summer and winter. However, the patterns of species observed changed from season to season. (Cassar-FRC)
W81-01874

TOXICITIES OF MICROCYSTIS AERUGINOSA COLLECTED FROM SOME LAKES, RESERVOIRS, PONDS AND MOAT IN TOKYO AND ADJACENT REGIONS,
Tokyo Metropolitan Research Lab. of Public Health (Japan).
M. F. Watanabe, and S. Oishi.
Japanese Journal of Limnology, Vol 41, No 1, p 5-9, January, 1980. 5 Tab, 10 Ref.

Descriptors: *Algae, *Toxicity, *Eutrophication, Water pollution effects, Cyanophyta, Microcystis aeruginosa, Surface waters, Tokyo, *Japan, *Lakes, Reservoirs, Ponds, Aquatic algae, Algal toxins, Potable water.

Microcystis aeruginosa, a blue-green alga observed in eutrophied waters, was harvested from lakes, reservoirs, ponds, and moats in and near Tokyo. Mice were injected intraperitoneally with 0.2 ml of the crude, heat-treated algae extracts and with extracts treated to destroy protein components. Crude algae extracts from 5 of 10 bodies of water caused death in mice in 1 to 2 hours. Toxicity was decreased by pepsin treatment of the extracts and eliminated by trypsin treatment, suggesting that the toxin is a heat-stable peptide or protein. In a dilution test 50 mg per ml was the minimum lethal dose, corresponding to 330-400 mg per kg. (Cassar-FRC)
W81-01876

RESOLUTION OF AN INDUSTRIAL WASTE DILEMMA,
Quicksall (W. E.) and Associates, Inc., New Philadelphia, OH.
J. R. Morgan.
Public Works, Vol 111, No 8, p 57-59, August, 1980. 3 Fig.

Descriptors: *Nitrates, *Industrial wastes, *Sludge, Treatment facilities, *Skimming, Performance, Waste water treatments, *Floating sludge, Rubber extrusion, Curing agent.

Problems with floating sludge caused by an unknown industrial waste caused BOD and suspended solids removal levels to deteriorate at the waste water treatment facility at New Philadelphia, Ohio. The amount of floating sludge in the primary clarifiers was much greater in the summer months, but the process was more seriously affected during the winter months. Manual skimming was the only way to really remove the floating sludge. Excess nitrates, higher than 1000 mg/liter in the influent, seemed to be the cause of the sludge. The trunk sewer area responsible for the excess nitrates was located and the offender was found to be a small rubber extruding industry. Potassium nitrate was used as a curing agent in the extrusion process. Initial efforts of the industry to control nitrate levels were not very successful. When the industry attempted to recover the salt, not only was the floating sludge problem solved, but the industry saved $20,000 per year. (Small-FRC)
W81-01879

FINDING THE RIGHT RX FOR TASTES AND ODORS,
York Water Co., PA. Purification Dept.
For primary bibliographic entry see Field 5F.
W81-01894

EXPERIMENTAL ACIDIFICATION OF A STREAM IN THE HUBBARD BROOK EXPERIMENTAL FOREST, NEW HAMPSHIRE,
Cornell Univ., Ithaca, NY. Div. of Biological Sciences.
R. J. Hall, G. E. Likens, S. B. Fiance, and G. R. Hendrey.
Ecology, Vol 61, No 4, p 976-989, August, 1980. 6 Fig, 3 Tab, 62 Ref.

Descriptors: *Acid streams, *Precipitation(Atmospheric), *Environmental effects, *Ecosystems, Acidic water, Ecosystems, Hydrogen ion concentration, On-site investigations, Diptera, Mayflies, Aquatic fungi, Water chemistry.

To simulate the effects of the increased acidity of rain on an ecosystem, dilute concentrations of sulfuric acid were added to Norris Brook, a stream in the Hubbard Brook Experimental Forest, West

Thornton, New Hampshire. The stream was maintained at pH 4 from April to September 1977. With increased acidity, stream water concentrations of the following were elevated: Al, Ca, Mg, K, and probably Mn, Fe, and Cd. There was decreased emergence of adult mayflies (Ephemeroptera), some stoneflies (Plecoptera), and some true flies (Diptera). The number and diversity of aquatic insects in collector, scraper, and predator functional groups decreased in drift. Aquatic hyphomycetes decreased, but the fungal community and periphyton biomass increased. Thus, the biotic structure, metabolism, and biogeochemistry of the stream ecosystem were altered at a pH level commonly found in precipitation. These findings are consistent with the hypothesis that heterotrophs may control biomass and primary production of attached plants in stream ecosystems by increasing energy transfer between primary and secondary trophic levels. (Small-FRC)
W81-01900

5D. Waste Treatment Processes

EVALUATION OF 19 ON-SITE WASTE TREATMENT SYSTEMS IN SOUTHEASTERN KENTUCKY,
Parrott, Ely, and Hurt, Lexington, KY.
J. L. Abney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-111015, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-101, July, 1980. 83 p, 18 Fig, 15 Tab, 15 Ref, 2 Append. CA-8-2575-A.

Descriptors: *Sewage disposal, *Rural areas, *Kentucky, *Sewage treatment, Prototypes, Septic tanks, Incineration, Soil properties, Operation and maintenance, Costs, Recycling, Safety, Public health, Social aspects, Performance, Incinerating toilets, Recycling toilets, Extended aeration tanks.

In 1970, many of the homes in rural Southeastern Kentucky were lacking adequate sanitary facilities for the disposal of human wastes. Shallow soils, steep slopes, and high groundwater levels made it difficult to provide sanitary wastewater disposal systems at a reasonable cost. Forty to sixty percent of the households had annual incomes of less than $3,000 in 1969. This report provides a summary of the design, installation, operation and maintenance, performance, and costs of nineteen prototype on-site systems installed in 1970-72. These systems included electric and gas-fired incinerating toilets, recycling toilets, extended aeration units followed by open sand filters, septic tanks followed by open sand filters, septic tanks followed by horizontal sand filters, and septic tanks followed by soil absorption trenches. In addition, the alternatives are evaluated against a set of criteria which includes user acceptance, health protection, safety energy requirements, longevity, frequency of maintenance, and capital and operation/maintenance costs. The septic tank-soil absorption systems were found to have the lowest cost and highest level of performance. Where suitable soils are located or can be economically imported, this would be the preferred system. (Moore-SRC)
W81-01681

AN ECONOMIC ANALYSIS OF EFFLUENT STANDARDS FOR BOD, AMMONIA, TOTAL SUSPENDED SOLIDS, AND DISINFECTION: CASE STUDY OF A MODERN TREATMENT PLANT,
Donald L. Hey and Associates, Chicago, IL.
D. L. Hey, J. M. Pappas, and L. C. Cox.
Illinois Institute of Natural Resources Document No 80/25, November, 1980. 46 p, 3 Fig, 22 Tab, 24 Ref.

Descriptors: *Waste water treatment, *Operating costs, *Treatment facilities, *Variable costs, Alternative planning, Analysis, Biochemical oxygen demand, Municipal wastes, Waste treatment, Waste water(Pollution), Waste water disposal, Water pollution, Water pollution treatment, Costs, Water management(Applied), Water quality control, Cost analysis, Economic efficiency, Ammonia, Suspended solids, Effluents, Standards.

Stricter effluent limits have economic effects in both capital and operating costs. Variable effluent limits will require the same capital facilities as fixed limits, but cost analysis of the Downers Grove treatment plant showed that operating cost for variable limits would be 21% less ($266,000 less) than for fixed limits. Controlling BOD variably (following the seasonal standards) would account for 12% ($33,000) of the savings; seasonal nitrification, 39% ($104,000); and elimination of chlorination, 44% ($108,000), saving 1.87 million kilowatt hours in the process. Reasons are given for the observation that the return on investment in variable (or fixed) effluent limits is uncommensurate with the operating or facility costs. It is recommended at maximum that variable limits be used to regulate the quality of treatment plant effluents. An alternate to variable limits operation would be instream treatment, operated on a regional scale, which, if deemed beneficial, would be less costly than nitrification facilities construction at all tributary plants, and would offer low-cost determination of water quality limitations to propagation of desirable aquatic organisms. (Zielinski-IPA)
W81-01701

THE PRESENT STATE OF POLLUTION CONTROL TECHNOLOGY FOR THE FISHING INDUSTRY,
Fisheries and Marine Service, Vancouver (British Columbia). Vancouver Lab.
F. G. Claggett.
In: Pollution and the Fisheries: Proceedings, 27th Annual Meeting of the Fisheries Council of Canada, Environmental Protection Service Report No EPS 3-WP-73-4, August, 1973, p 22-27.

Descriptors: *Fisheries, *Water pollution sources, *Water pollution treatment, *Canada, *Water pollution control, *Costs, Decontamination(Water), Treatment, Flotation, Filtration, Abatement, Application equipment, Biodegradation, Pollutants, Sewage treatment, Water pollution sources, Control, Industrial production, Alternative costs, Construction costs.

In light of developing environmental standards, four questions were discussed concerning the Canadian fishing industry: (1) are we polluting; (2) if so, to what extent, and what are the pollutants; (3) how much must be removed to meet the standards; and (4) which is the least expensive method. Answers to the first two questions are: yes, most of the larger plants are probably polluting; among the pollutants are fish particles, oil, blood, and slime which exert a biological oxygen demand on the receiving waters. The least degree of treatment demand will be physical removal of insoluble solids. Tangential screens can reduce the solids load by 50% after prescreening by trommel screens. A full-scale demonstration plant to treat waste water from fishing plants concentrates solids from 300,000 gallons/day into 6000 gallons of sludge, reducing the pollution load 80%. Further treatment alternatives are (1) waste water discharge to the municipal sewer system, or (2) use of an aerated lagoon. Tangential screen cost ($6000) can be recovered in two years; a 500 gallon/minute treatment plant costs about $75,000, and 15-25 cents/1000 gallons to operate; municipal sewer use (moderate size salmon canning plant), about $75/day user charges; a five-acre lagoon, $35,000, and about 8 cents/1000 gallons to operate. (Zielinski-IPA)
W81-01706

ENTEROVIRUS AND COLIPHAGE INACTIVATION DURING ACTIVATED SLUDGE TREATMENT,
New Mexico State Univ., Las Cruces. Dept. of Biology.
J. S. Glass, and R. T. O'Brien.
Water Research, Vol 14, No 7, p 877-882, July, 1980. 2 Fig, 6 Tab, 14 Ref. OWRT-A-052-NMEX(9).

Descriptors: *Viruses, *Bacteriophages, *Activated sludge, *Sludge treatment, Laboratory tests, Waste water treatment, Disinfection, Mathematical studies, Adsorption, Bioindicators, Model studies, Pilot plants.

The inactivation rates of enteric viruses and coliphages in a large volume activated sludge unit at New Mexico State University were examined in pilot plant studies. The fraction of total virus removed that was attributed to inactivation was also examined. Poliovirus 1, coxsackievirus B-1 and indigenous coliphage inactivation closely resembled first order kinetics with inactivation rates which were not dependent on flow rates of the mixed liquor. No significant differences were found between the enterovirus and coliphage inactivation rates indicating that phage inactivation might be used as an indicator for enterovirus inactivation during activated sludge treatment. Determinations were made of total virus removal from mixed liquor and an overall average rate constant for phage and virus inactivation was calculated. A plot of percent virus survival versus hours of exposure to activated sludge treatment was also generated. (Geiger-FRC)
W81-01708

CAPACITY OF ACTIVATED SLUDGE SOLIDS FOR VIRUS ADSORPTION,
California Univ., Los Angeles. Dept. of Chemical, Nuclear and Thermal Engineering.
V. L. Vilker, R. S. Kamdar, and L. H. Frommhagen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-127210, Price codes: A04 in paper copy, A01 in microfiche. Chemical Engineering Communications, Vol 4, p 569-575, 1980. 3 Fig. (California Water Resources Center Project UCAL-WRC-W-523). OWRT-B-184-CAL(6).

Descriptors: *Waste water treatment, *Viruses, *Water reuse, *Activated sludge, Soil testing, Soil properties, Adsorption, Biological treatment.

The first significant reduction in wastewater virus concentration occurs in the biological treatment process, either by removal of solid matter in which virus is embedded or by adsorption of virus to the biomass. In addition, the effectiveness of subsequent disinfection and the ultimate fate of treatment plant effluent virus are dependent on the extent of virus association with small suspended particles. This report is a study of adsorption of Type I poliovirus to solids collected from an activated sludge unit and resuspended in filtered final effluent. Virus adsorption capacity was correlated by an isotherm relationship which includes the effect of decreasing capacity with increasing solids concentration. This effect is probably caused by decreased solids surface area due to solids aggregation. The results indicate smaller capacity at typical activated sludge mixed liquor solids concentration than would be predicted from previous studies, and that only about 20% of total virus are absorbed at low solids concentration typical for treatment plant effluent. (Snyder-California)
W81-01710

PROCESS FOR REMOVING SULFATE IONS FROM AQUEOUS STREAMS,
Du Pont de Nemours and Co., Wilmington, DE. (Assignee).
J. L. Balmat.
U.S. Patent No 4,200,523, 6 p, 1 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 5, p 1744, April 29, 1980.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Separation techniques, Sulfates, Anaerobic conditions, Sulfur bacteria, Recycling.

Sulfate ions contained in aqueous streams essentially free of organic carbon such as sulfuric acid streams are converted into more recoverable form by subjecting the stream to the action of sulfate-reducing bacteria in an inorganic, anaerobic system in the presence of an excess of calcium carbonate and converting the resultant sulfide ions into an undissolved vapor or solid phase to facilitate recovery. (Sinha-OEIS)
W81-01713

BIO-SURFACE SEPARATION PROCESS,
Biospherics Inc., Rockville, MD. (Assignee).
G. V. Levin.
U.S. Patent No 4,200,524, 5 p, 1 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 993, No 5, p 1745, April 29, 1980.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Separation techniques, Aeration, Biological treatment, Activated sludge, Microorganisms, Bio-surface particulates.

An activated sludge sewage treatment process comprises mixing influent sewage material with activated sludge and bio-surface particulates to provide a mixed liquor. The mixed liquor is passed to an aeration zone where it is contacted with an oxygen-containing gas to reduce the BOD content. The mixed liquor is then passed to a settling zone to separate bio-surface particulates having sludge particles adherent and a clarified supernatant. The clarified supernatant is removed from the settling zone and is discharged as effluent or routed for further treatment. At least a portion of the bio-surface particulates having adherent sludge is subjected to a treatment to separate at least of portion of the adherent sludge particles. The treated portion is then passed to a bio-surface particulate sludge separator. In this separator, the sludge present in the mixture which is not adherent to the bio-surface particulates separates and is passed out of the system as waste sludge. The bio-surface particulates and remaining sludge are then recycled for mixing with influent sewage material. (Sinha-OEIS)
W81-01714

PROCESS FOR TREATING WASTE WATER,
Gerber Products Co., Fremont, MI. (Assignee).
E. W. Johnson, M. J. Reider, R. Anewalt, and H. J. Kring.
U.S. Patent No 4,300,526, 6 p, 2 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 5, p 1745, April 29, 1980.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Separation techniques, *Reverse osmosis, Reduction(Chemical), Flocculation, Filtration, Textiles, Fibers(Plant), Recycling.

Reverse osmosis treatment of the waste effluent from a textile plant is rendered feasible by first removing from the raw effluent as much of the pollutants as possible. After preliminary filtering to remove foreign particles, the waste water is treated with a reducing agent, if needed, and the pH adjusted to 8.0-9.5. The waste water is then treated with a flocculating agent. After further treatment in a clarifier, the waste water is passed through a sand filter to remove any residual suspended solids. The pH is adjusted to below about 6.0 and the waste water is then subjected to reverse osmosis. Approximately 90% of the raw effluent water has been found to be recovered for recycling. (Sinha-OEIS)
W81-01715

REMOVING METAL IONS FROM AQUEOUS EFFLUENTS,
PQ Corp., Valley Forge, PA. (Assignee).
V. J. Cassella, and M. R. Irani.
U.S. Patent No 4,200,528, 6 p, 1 Fig, 5 Tab, 7 Ref; Official Gazette of the United States Patent Office, Vol 993, No 5, p 1746, April 29, 1980.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Separation techniques, Ions, Metals, Chemical reactions, Tannery wastes, Chromium, Magnesium compounds, Product recovery.

The invention provides a method for removing various metal ions before waste effluents are released to the environment. Most particularly, the invention relates to removing and recovering chrome values from tanning effluents. Amorphous, hydrated magensium silicate is mixed with aqueous effluent. The slurry of magnesium silicate in the effluent is heated and/or adjusted in pH if desired. The metal ions (90% or more) are complexed by the silicate and effectively removed from the effluent by filtering off the silicate. The slurry of silicate and chrome tanning effluent is adjusted to and/or maintained at a pH of 5.3 to 9.8 to attain more than 90% removal of tri-valent chromium ions. Large proportions of the complexed metal ions can be recovered by acid treatment of the filtered material. (Sinha-OEIS)
W81-01716

APPARATUS FOR RENOVATION OF SANITARY WATERS,
F. Besik.
U.S. Patent No 4,200,534, 6 p, 1 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 993, No 5, p 1748, April 29, 1980.

Descriptors: *Patents, *Waste water treatment, *Domestic wastes, Aeration, Suspended solids, Chemical reactions, Oxidation, Equipment.

A selfcontained apparatus for on-site renovation of sanitary waters is comprised of three aeration chambers. They are: a mineral storage and dispensing container, a submerged suspended solids separator located in the third aeration chamber, a flow equalizer, a chemical oxidizing agent dispe sing system, a chemical oxidation-clarification chamber and a charcoal containing chamber, all enclosed in a single tank designed for use on land as a single or multiple family waste water renovation system, or off-shore as a marine sanitation device. (Sinha-OEIS)
W81-01717

METHOD AND APPARATUS FOR THE ENHANCED TREATMENT OF FOOD PROCESSING WASTE WATERS USING AEROBIC MICROORGANISMS,
D. A. Rollag, J. N. Dornbush, and R. C. Renner.
U.S. Patent No 4,201,663, 5 p, 2 Fig, 18 Ref; Official Gazette of the United States Patent Office, Vol 994, No 1, p 248, May 6, 1980.

Descriptors: *Patents, *Waste water treatment, *Organic wastes, *Food processing industry, Odor, Gases, Aerobic bacteria, Absorption, Adsorption, Biodegradation, Microorganisms.

The severe odor problem which is inherent in the anaerobic lagoon treatment method to purify the waste waters from meat, poultry, and other food processing plants, greatly limits the possible locations for treatment sites and creates a severe environmental problem. Accordingly a general object of this invention is to provide an improved method and apparatus for aerobic bacterial decomposition of odorous gases generated by the anaerobic bacteriological decomposition of organic liquids to thereby minimize the odor problem inherent in prior art anaerobic lagoon treatment processes. The process uses a plastic film to support an air transport system and a blanket of inexpensive biodegradable material which provides the functions of heat insulation, odor absorption/adsorption and mechanical support for attached aerobic microorganisms which act to decompose odorous gases. (Sinha-OEIS)
W81-01722

ULTRAFILTRATION OR REVERSE OSMOSIS TREATMENT OF EMULSIFIED OIL METAL WORKING COOLANTS,
Continental Group, Inc., New York. (Assignee).
I. M. Hekal.
U.S. Patent No 4,201,664, 5 p, 1 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 994, No 1, p 249, May 6, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Separation techniques, Reverse osmosis, Emulsions, Oil wastes, *Oily water, Ultrafiltration, Product recovery.

A portion of the oil-in- water emulsion used as a lubricant/coolant in the shaping of metal articles such as containers is subjected to a reverse osmosis or ultrafiltration process to concentrate the oil portion and separate a water permeate. The oil concentrate is reincorporated in the remaining portion of the coolant and the permeate is used as rinse water to remove oil residues retained on the article from the metal shaping operation. The coolant is then reconstituted with the oil residue rinsed from the article. By using permeate derived from the coolant for the rinsing and then reconstituting the coolant with the effluent collected from the permeate rinsing of the article, the oil normally lost with the disposal of rinse water is recovered and the water disposal problem associated with such effluent is substantially eliminated. The presence of surfactant in the permeate rinse water provides the additional advantage that the surfactant promotes the removal of the adhered oil from the metal article being rinsed. (Sinha-OEIS)
W81-01723

USE OF NONSTOICHIOMETRIC CARBON-SULFUR COMPOUNDS TO REMOVE COMPONENTS FROM LIQUIDS,
Exxon Research and Engineering Co., Florham Park, NJ. (Assignee).
For primary bibliographic entry see Field 5G.
W81-01724

TREATING PULP-AND-PAPER MILL STREAMS,
Sprague Electric Co., North Adams, MA. (Assignee).
J. A. Newton.
U.S. Patent No 4,201,666, 3 p, 2 Tab, 11 Ref; Official Gazette of the United States Patent Office, Vol 994, No 1, p 249, May 6, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Pulp and paper industry, Chemical wastes, polyelectrolytes, Flocculation, Color, Sedimentation.

Aqueous pulp-and-paper mill waste streams are treated with a waste stream derived from the nitric acid etching of aluminum foil for electrolytic capacitors. This waste stream consists essentially of aqueous acidic aluminum nitrate, and a polyelectrolyte is added to it to synergistically improve flocculation, settling, and dosage rates. One of the purposes of this invention is the utilization of a waste stream to treat another waste stream, thereby simplifying the disposal of each and reducing chemical requirements. (Sinha-OEIS)
W81-01725

PROCESS FOR REMOVING ARSENIC FROM AQUEOUS MEDIUMS,
FMC Corp., Philadelphia, PA. (Assignee)
H. P. Liao.
U.S. Patent No 4,201,667, 7 p, 11 Tab, 4 Ref; Official Gazette of the United States Patent Office, Vol 994, No 1, p 249, May 6, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Separation techniques, Chemical precipitation, *Arsenic compounds, Phosphorus, Hydrogen ion concentration.

An improved process for treating an aqueous, arsenic-containing medium provides for the rapid removal of the major portion of arsenic, and also minimizes residual arsenic which may normally be present as water-soluble compounds. The process comprises incorporating into an aqueous, arsenic-containg medium, and in the presence of phosphorus, sufficient calcium hydroxide ($Ca(OH)_2$) to adjust the aqueous medium to a pH of from 7.0 to 11.5, thereby causing both the arsenic and phosphorus to precipitate, and thereafter separating the precipitates. Residual concentrations of arsenic and phosphorus, which are in lower oxidation states and thus are normally present as water-soluble compounds, are minimized by the oxidation with chlorine, preferably before the addition of the $Ca(OH)_2$, to more insoluble compounds which are separated as precipitates from the aqueous medium. (Sinha-OEIS)
W81-01726

PROCESS AND DEVICE FOR THE AERATION OF WASTE WATER,
Stamicarbon, B. V., Geleen (Netherlands). (As-

signee).
F. J. Fontein, and H. F. Jennekens.
U.S. Patent No 4,202,762, 10 p, 4 Fig, 2 Tab, 7 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 623, May 13, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Biological treatment, Aeration, Activated sludge, Equipment, Jets, Circulation.

Waste water containing suspended biologically active sludge and circulating in an endless path in a vessel is aerated by withdrawing a stream of the water and recycling it to the vessel in the form of downwardly directed jets which penetrate the water surface and thereby entrain air in the water. The jets are directed onto the water surface at an angle of less than 60 degrees and the horizontal component of the motion of the jets is substantially parallel to the recirculation path of the main body of water at the point of impact. The jets are divided regularly over the water surface of the vessel. (Sinha-OEIS)
W81-01732

HIGH-EFFICIENT ACTIVATED SLUDGE METHOD,
Hitachi, Ltd. (Japan). (Assignee).
N. Shimizu, and Y. Odawara.
U.S. Patent No 4,202,763, 9 p, 5 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 624, May 13, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Biological treatment, Aeration, Activated sludge, Oxygen.

Waste water containing organic materials is introduced into an aeration tank, and is subjected to aeration treatment in the presence of activated sludge, while supplying oxygen to the aeration tank. The organic materials contained in the waste water are oxidized by high-efficient activated sludge at a high oxygen transfer rate. (Sinha-OEIS)
W81-01733

PROCESS FOR REMOVING OIL PARTICLES FROM WASTE WATER CONTAINING THE SAME,
H. Ono, T. Saida, and K. Fukumura.
U.S. Patent No 4,202,766, 5 p, 5 Tab, 9 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 624-625, May 13, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Oil wastes, Adsorption, Coagulation, Calcium hydroxide, Filtration.

The process of the invention comprises introducing into the waste water at least one compound selected from the group consisting of hydroxides and oxides of calcium for absorbing and/or coagulating the oil particles; introducing an acid into the waste water for dissolving the compound to permit the oil particles to be freed and/or converted into larger-size oil particles; and finally, separating the liberated oil from the waste water. The oil thus liberated is easily separated by permitting it to rise to the surface of the waste water by specific gravity difference. Upon separation, the oil particles having larger sizes can be removed almost directly. Smaller particles are removed by a filter having oleophilic synthetic resin fibers. (Sinha-OEIS)
W81-01734

PROCESS AND DEVICE FOR THE PURIFICATION OF WASTE WATER BY MEANS OF ELECTROFLOTATION,
Stamicarbon, B.V., Geleen (Netherlands). (Assignee).
M. Alfenaar.
U.S. Patent No 4,202,767, 4 p, 2 Tab, 2 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 625, May 13, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Electrodes, Foam separtion, Suspended solids, Equipment, *Electroflotation.

A process for separating emulsified or suspended substances from waste water by electroflotation comprises passing that waste water through electrodes consisting of perforated material to produce a foam of gas and entrapped particles which were suspended or emulsified in the waste water and removing the foam. The diameter of the apertures of the material of the lower electrode is at most 5 millimeters and at least as large as is necessary to ensure proper passage of the liquid without hindrance to the upward movement of the gas bubbles through the liquid. (Sinha-OEIS)
W81-01735

APPARATUS FOR PURIFICATION OF WASTE WATER BY MEANS OF ACTIVE CARBON,
Berghau-Forschung G.m.b.H., Essen (Germany, F.R.). (Assignee).
G. Gappa, H. Juntgen, and J. Klein.
U.S. Patent No 4,202,770, 7 p, 2 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 626, May 13, 1980.

Descriptors: *Patents, *Waste water treatment, *Water purification, Separation techniques, Activated carbon, Organic wastes, Adsorption, Flow control, Equipment.

An apparatus for purification of waste water includes an upright adsorber filled with active carbon passing in downward direction through the adsorber while waste water flows in an upward direction. A distributing arrangement at the region of the lower end of the adsorber, into which waste water is fed, is provided to assure a substantial even distribution of the waste water during its upward flow through the carbon column. Furthermore, a regulating arrangement is provided to regulate the flow of the carbon through the adsorber in dependence on the concentration of the organic contaminants adsorbed by the carbon. (Sinha-OEIS)
W81-01737

SUPERVISION AND CONTROL SYSTEM AT THE KANAGAWA WASTE WATER TREATMENT PLANT, YOKOHAMA,
Sewage Works Bureau, Yokohama (Japan).
Y. Hattori.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 931-937, May, 1980. 3 Fig, 2 Tab.

Descriptors: *Waste water treatment, *Automatic control, *Treatment facilities, *Computers, Data processing, Automation, Equipment, Quality control, Management, Personnel, Japan, *Yokohama(Japan).

The supervision and process control system at the Kanagawa waste water treatment plant (Yokohama, Japan) is a tier-distributed processing system equipped with a computer. The system was designed to enhance automation of the plant, reduce labor costs, provide a wide range of supervision, and improve quality control by the sensors, including the qualitative measuring instruments. The operation and control of the plant including two pumping relay stations are supervised and controlled by two operators during the night and on holidays. The centralized supervision system provides process values and the status of many different operations, as well as controlling local processes and the relay pumping stations. The quantitative and qualitative measurement and control system has duplicate instrumentation and mutual backups for vital measurements. Qualitative and quanitative measurements are displayed on the CRT and recorded on recording meters and automatically fed to a series of programs to produce daily and monthly reports. The system also does everything necessary for the plant to obtain stable operation; the choice of treatment mode can be changed to meet influent needs. The system is still under development. (Small-FRC)
W81-01765

KINETICS OF PHENOL DEGRADATION BY ACTIVATED SLUDGE IN A CONTINUOUS-STIRRED REACTOR,
Milan Univ. (Italy). Inst. of Physical Chemistry.
P. Beltrame, P. L. Beltrame, P. Carniti, and D. Pitea.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 126-133, January, 1980. 6 Fig, 3 Tab, 11 Ref.

Descriptors: *Activated sludge, *Phenols, Industrial wastes, Domestic wastes, *Waste water treatment, Mathematical studies, Water pollution treatment, Equations, Biodegradation, Biological treatment.

Three activated sludges, labeled A, B, and C, obtained from the industrial and domestic waste water treatment plant at Parabiago, Italy, were adapted to phenol as the sole carbon source. Kinetics of phenol degradation in a continuous stirred reactor were monitored by the 4-amino-antipyrine method. Kinetic runs were performed at 20 degrees C with sludges A, B, and C with a hydraulic retention time of 1.56 hours and with sludge C with a hydraulic retention time of 6.25 hours. Results showed that phenol was degraded by an adapted activated sludge with kinetics resembling those reported for other cases of mixed culture aerobic waste treatment. In the concentration range tested (up to 360 milligrams/liter in the influent), no substrate inhibition was evidenced, although the large saturation constant (245 milligrams/liter) suggested a greater difficulty in achieving low phenol levels than with other wastes. The rate of phenol removal by a sludge was affected to some extent by the type of sample initially used for preparing the adapted sludge. Influent phenol concentrations had a marked effect on the rate of phenol removal by a sludge. (Geiger-FRC)
W81-01786

CONTROL OF AEROBIC DIGESTION BY SUBSTRATE CONCENTRATION,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
M. F. Hamoda, and J. Ganczarczyk.
Canadian Journal of Civil Engineering, Vol 7, No 3, p 456-465, September, 1980. 8 Fig, 4 Tab, 17 Ref.

Descriptors: *Activated sludge, *Aerobic treatment, *Suspended solids, Performance, Nitrification, Sludge digestion, Laboratory tests, Waste treatment.

Laboratory studies on aerobic digestion of activated sludge showed that an initial concentration of solids might be effective in reducing digester volume required for sludge stabilization and in lowering the associated rates of nitrification. The use of activated sludges of higher solids concentration in aerobic digesters may be a means of reducing the required digester volume. In the studied range of concentrations (to 3.5%), significant reductions of volatile suspended solids could be achieved with 10 to 15 days detention time at 20C, and a stable product sludge was obtained. Higher solids concentrations were associated with lower rates of nitrification. Thus, sludge solids concentration could be used to control nitrogen transformation during aerobic digestion of organic sludges. This could reduce sludge stabilization oxygen requirements. There are similar trends in batch digestion and semicontinuous digestion systems, but the method is not totally applicable to the design of continuous flow aerobic digesters. (Small-FRC)
W81-01787

COMPARISON OF CHLORINE DIOXIDE AND CHLORINE IN WASTE WATER DISINFECTION,
Stanford Univ., CA. Dept. of Civil Engineering.
E. M. Aieta, J. D. Berg, P. V. Roberts, and R. C. Cooper.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 810-822, April, 1980. 10 Fig, 7 Tab, 16 Ref.

Descriptors: *Chlorine, *Water purification, *Disinfection, Viricides, Water pollution control, Performance, *Waste water treatment, Bacteria, Ef-

fluents, Chlorine dioxide, Residuals, Coliforms, California, *Palo Alto(CA).

Chlorine and chlorine dioxide gave essentially equivalent coliform survival ratios when waste water treatment effectiveness was compared. Secondary effluent from a conventional activated-sludge process at Palo Alto Water Pollution Control Plant was used in the evaluations. The disinfectants were compared on a mass dose basis at a 30-minute contact time in non-nitrified secondary effluent. Chlorine dioxide was a more rapid agent, effecting greater bacterial inactivation than combined chlorine at the shorter contact times. On a residual basis, chlorine dioxide achieves the same survival ratio as chlorine, but with a lower residual concentration when chlorine exists as chloramines. The dose required to maintain a given residual in waste water is greater for chlorine dioxide. Chlorine dioxide was a more effective viricide than combined chlorine when investigated by measuring Poliovirus I survival in secondary effluent. (Small-FRC)
W81-01792

SOLIDS SEPARATION IN ACTIVATED SLUDGE SYSTEM DESIGN AND OPERATION,
A. W. Busch, and R. L. Irvine.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 804-809, April, 1980. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Suspended solids, *Activated sludge, *Design, *Sewage treatment, Filtration, Coagulation, Sedimentation, Technology, Performance, Standards, Water quality, Upgrading, Separation techniques.

The design and operation of five systems to reduce suspended solids in activated sludge systems are discussed. This improved treatment level will be necessary to reach the goal of fishable and swimmable public waters by 1983. Case I is the modification of an existing system at the secondary treatment level only. The secondary clarifier must be operated properly, or the biological reactor must utilize organisms that have good settling characteristics. Case II is the modification of an existing system by add-on filtration. Case III is the modification of an existing system at the secondary level plus add-on filtration. Case IV is the modification of an existing system by add-on coagulation, sedimentation, and filtration. These three systems all add some further treatment. Case V is a new system design which optimizes biological removal of soluble substrates and chemical removal of suspended solids. The Garrett scheme for hydraulic control of biomass growth rate is shown to be cost effective in overall system assessment. To meet higher effluent quality requirements, adding on more treatment stages is shown to be not cost effective and may not even accomplish the objective. Case V may be the best answer. (Small-FRC)
W81-01793

CARBON ADSORPTION ENHANCEMENT WITH OZONE,
Culp/Wesner/Culp, Cameron Park, CA.
R. L. Culp, and S. P. Hansen.
Journal of the Water Pollution Control Federation, Vol 52, No 2, p 270-281, February, 1980. 8 Fig, 1 Ref.

Descriptors: *Activated carbon, *Chemical oxygen demand, *Ozone, *Organic loading, Cost analysis, Adsorption, Organic compounds, *Waste water treatment, Effluents, South Tahoe(CA), California, Chlorination, Bacteria, Waste treatment, Cost estimates, Pilot plants, Filtration.

Adding ozone (3 or 10 mg per liter) during activated carbon treatment of secondary effluent did not sufficiently enhance COD removal in pilot plant studies at South Tahoe, California, to warrant installation of a full-scale plant. Tests were continued until COD breakthrough occurred. The best test results showed an 80% increase in adsorptive capacity, but these high results were not duplicated in subsequent runs. Several characteristics of the system in this facility contributed to the negative results--chlorine residuals and low soluble COD in the effluent and low biological activity and normally aerobic conditions on the adsorption bed. Ozone-enhanced activated carbon adsorption has been used successfully in Europe and in Cleveland, where different conditions prevail. It is believed that several factors affect the results of ozone addition--nature of the organic material, amount of organic loading, presence or absence of aerobic conditions, species and growth of bacteria, and pretreatment of effluent. (Cassar-FRC)
W81-01799

EFFECT OF PRECIPITATION AND EVAPOTRANSPIRATION OF A SEPTIC TANK-SAND FILTER DISPOSAL SYSTEM,
Ontario Ministry of the Environment, Toronto. Applied Sciences Section.
M. Brandes.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 59-75, January, 1980. 4 Fig, 8 Tab, 24 Ref.

Descriptors: *Septic tanks, *Precipitation(Atmospheric), *Evapotranspiration, Domestic wastes, Coliforms, Sands, Filters, Flow, Nitrogen, Phosphorus, *Waste water treatment, Performance, Soil disposal fields.

A field study investigated the year-long operation of a newly constructed large underdrained sand filter and determined the effect of atmospheric precipitation and evapotranspiration on the removal of chemical and bacterial contaminants by the sand filter medium. The waste water treatment system consisted of a two-compartment septic tank and a sand filter equipped with measuring devices for monitoring waste water flow and periodically collecting samples. The average precipitation rate for the year was 2.47 mm/d, and the average evapotranspiration rate was 1.44 mm/d, or 58.3% of the precipitation. During the snow melt season, the outflow from the sand filter was about twice as high as the inflow; and during the summer months, the evapotranspiration rate exceeded the precipitation rate by 8.8%. The retention of phosphorus by the filter medium was 42.6%, and the removal of total nitrogen was 40.4%. The removal of total and fecal coliforms was almost 100%. Soil filters should be designed to enable a maximum possible runoff to reduce the infiltration of water from atmospheric precipitation. Higher sun exposure and evapotranspiration are advantages of soil filter operation. (Small-FRC)
W81-01800

EFFECTS OF COAL SLURRY ON WASTE WATER BACTERIA AND BACTERIOPHAGE,
Science Applications Inc., Los Angeles, CA.
L. W. Margler, and M. B. Rogozen.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 53-58, January, 1980. 1 Fig, 3 Tab, 20 Ref.

Descriptors: *Coals, *Adsorption, *Bacteria, Waste water treatment, Laboratory tests, Bacteriophage, Coliforms, Slurries, Pipelines.

The possibility that waste water exposure to coal in a slurry pipeline would upgrade the microbiological quality of the waste water effluent was examined. Bacterial adsorption onto coal might be possible, and then the bacterial population would be removed from the water along with the coal at the end of the pipeline. Bacteria adsorbed onto finer coal particles that pass through centrifuges or filters would be removed during clarification of recovered slurry water. Also, coal contains numerous organic compounds and heavy metals that can be toxic to bacteria. Laboratory experiments indicated that coal slurry was only mildly toxic to coliform bacteria; there was a 70% reduction in coliforms, and the fecal streptococcal concentration remained virtually unchanged. However, 99.8% of the E. coli C-specific phage present in the waste water became noninfective in the coal slurry; thus, exposure to coal slurry may upgrade the waste water. Further study is needed to determine the effect of slurry on pathogenic enteric viruses. (Small-FRC)
W81-01801

INDICATOR BACTERIA AND SALMONELLA IN FOOD-PROCESSING AND DOMESTIC EFFLUENT,
Elainlaaketieteellinen Korkeakoulu, Helsinki (Finland).
J. Hirn.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 48-52, January, 1980. 1 Fig, 3 Tab, 21 Ref.

Descriptors: *Coliforms, *Salmonella, *Food processing industry, Municipal wastes, Public health, Performance, *Waste water treatment, Biological treatment, Poultry, Finland.

The composition and reduction of the fecal indicator bacteria and Salmonella flora was studied in a treatment system that received its principal effluent from a food processing plant using broiler chickens and also received waste water from a rural community. Effluent and waste water samples were collected at the Saarioinen-Sahalahti treatment plant, located 200 km north of Helsinki (Finland). The plant has a high rate biological filter and serves the Saarioinen food processing plant (broiler chickens) and the rural Sahalahti community. The number of fecal coliforms was higher in the waste water, while the numbers of fecal streptococci in the two waters were almost equal. Biological and chemical purification reduced fecal coliforms and fecal streptococci by over 99%. Salmonella were found in the waste water and plant effluent. Salmonella infantis was detected in the effluent when infected flocks of chickens entered the plant. The continuous bacteriological control of the effluent from this type of food plant by analyses of the fecal indicators and Salmonella is of great public health importance. (Small-FRC)
W81-01802

A METHOD FOR THE CALCULATION OF BIOLOGICAL FILM VOLUME IN A FLUIDIZED BED BIOLOGICAL REACTOR,
McMaster Univ., Hamilton (Ontario).
M. Tsezos, and A. Benedek.
Water Research, Vol 14, No 6, p 689-693, June, 1980. 2 Fig, 3 Tab, 5 Ref.

Descriptors: *Biological treatment, *Mathematical models, Films, Fluidized bed reactor, Columns, Particle size, Particle shape, Aerobic, Activated carbon, *Waste water treatment, Bacteria.

This paper derives the theoretical relationships governing bed height and biofilm volume in a fluidized bed and attempts to determine the validity of these relationships through a comparison of calculated and experimentally determined particle diameters. The fluidized bed bioreactor was constructed from 10.2 cm i.d. plexiglass, and the medium chosen for study was granular activated carbon. Sources of error that might affect the validity of the calculations were inlet flow distribution problems, inaccuracies of direct particle diameter measurement methods, and inaccuracies in assumed biofilm density values. The authors concluded that (1) the expanded bed height in a fluidized bioreactor can be theoretically connected to biofilm volume in the reactor, (2) the proposed correlation can be used to calculate the biofilm volumetric yield, and (3) some of the error associated with particles without biofilm can be eliminated through the use of shape factors. (McKeon-FRC)
W81-01805

CALORIMETRIC STUDIES OF BIODEGRADATION PROCESSES IN BIOLOGICAL WASTE WATER TREATMENT,
Sherbrooke Univ. (Quebec).
J-L. Fortier, B. Reboul, P. Philip, M-A. Simard, and P. Picker.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 89-97, January, 1980. 7 Fig, 2 Tab, 11 Ref.

Descriptors: *Microcalorimetry, *Biodegradation, Analytical techniques, Monitoring, *Waste water treatment, Biological treatment, Biochemical oxygen demand, Chemical oxygen demand, Oxy-

genation, Cultures, Toxins, Kinetics, Sludge bacteria, Pilot plants.

Preliminary studies were carried out to test the use of a fast-response flow microcalorimeter for monitoring biodegradation processes in a waste water treatment plant. Calorimetric results were correlated with those from biochemical oxygen demand (BOD) and chemical oxygen demand (COD) studies. Calorimetric experiments consisted of those in which the effluent and culture were mixed inside the calorimetric cell and those in which mixing was performed outside. Adequate microwatt sensitivity for monitoring heat evolved during biodegradation was achieved. A heat output on the order of 24-500 microwatts could be determined from mixing a culture containing about 0.1% suspended solids with a biodegradable effluent (0.1% COD). Where the culture-effluent mixing could be carried out within the calorimetric flow cell, the time constant for the measurement was about 1 minute. When the mixing was done prior to injection in the flow cell, the overall time of the measurement increased to 2 minutes. In either method, important kinetic data may be obtained by monitoring the initial response of the culture to COD shock loads or inhibitors. Changes in heat flux determined by the present method were qualitatively correlated with results obtained from respirometric procedures, and the heat output is closely associated with the rates of the biodegradation reaction. (Geiger-FRC)
W81-01806

EFFECTS OF WATER CONSERVATION ON SANITARY SEWERS AND WASTE WATER TREATMENT PLANTS,
Los Angeles County Sanitation Districts, CA.
J. T. DeZellar, and W. J. Maier.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 76-88, January, 1980. 7 Fig, 10 Tab, 11 Ref.

Descriptors: *Water conservation, *Waste water treatment, Water utilization, Sewerage, Water quality, Flow rates, Suspended solids, Biochemical oxygen demand, Environmental effects, Nitrogen, Sulfur Phosphates, Effluents, Costs.

The effects of reduced water usage due to conservation measures on waste water collection and treatment systems were examined in relation to waste water composition, performance of collection and treatment facilities, and quality characteristics of treated effluent water. Conventional design correlations were used to describe sewer performance characteristics, while treatment system performance was evaluated using a published computer program. Results were compared with field data recorded from several California waste water treatment plants during conditions of drought from 1975 to 1977. Conservation measures caused reduced flows, resulting in sediment accumulations in sewer lines and methane and hydrogen sulfide corrosion of pipes due to anaerobic decomposition. Generally, biochemical oxygen demand (BOD) and total suspended solids increased, while the effects of reduced water use on nitrogen, sulfur and phosphate levels were inconclusive. Increased detention times in all unit processes were also noted with lower flows. Septic conditions often occurred in primary sedimentation tanks. Although concentrations of most parameters were increased in the final effluent, effluent loads were usually decreased, resulting in reduced environmental impacts. Specific suggestions for future plant designs to meet the challenges imposed by water conservation measures are offered. (Geiger-FRC)
W81-01807

NUTRIENT REMOVAL IN SUSPENDED GROWTH SYSTEMS WITHOUT CHEMICAL ADDITION,
Dorr-Oliver Inc., Stamford, CT.
P. M. Sutton, B. E. Jank, and D. Vachon.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 98-109, January, 1980. 11 Fig, 3 Tab, 22 Ref.

Descriptors: *Pilot plants, *Nutrient removal, Sludge, Nitrification, Denitrification, Sludge bacteria, *Waste water treatment, Biological treatment, Phosphorus, Nitrogen, Chemical oxygen demand, Organic compounds, Aerobic conditions, Anaerobic conditions.

A pilot plant study was conducted at the Waste Water Technology Center, Ontario, to obtain quantitative data on effects of various factors on P removal in single sludge systems and to determine the effects of anoxic and anaerobic conditions on the growth rates of the nitrifiers. Data was also acquired on N removal in single-sludge systems where denitrification relied on the organics present in the waste water and/or an external carbon source. Over a period of 4 months, three parallel single-sludge systems (A, B, and C) were operated according to a predetermined experimental design. Systems A and C were designed to achieve nitrification, partial denitrification, and enhanced P uptake. System B was designed to achieve only nitrification and served as a control. Systems D and E were designed to study N removal and give additional information on P removal. Results of the pilot plant operations showed that anaerobic conditions of up to 4 hours had no observable detrimental effect on nitrification. High levels of P removal were achieved in single sludge systems without chemical additions. The quantity of P removed was dependent on the level of COD removed in the system. Exposing the biological population to alternating anaerobic-aerobic conditions did not enhance P uptake into the sludge. A high level of N removal was obtained in single sludge systems without the addition of an external carbon source. (Geiger-FRC)
W81-01808

FACULTATIVE WASTE STABILIZATION POND DESIGN,
Humboldt State Univ., Arcata, CA.
B. A. Finney, and E. J. Middlebrooks.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 134-147, January, 1980. 10 Fig, 13 Tab, 14 Ref.

Descriptors: *Model studies, *Design criteria, *Oxidation lagoons, Kinetics, *Waste water treatment, Federal government, State governments, Mathematical studies, Equations, Organic loading, Hydraulic design, Flow profiles, Stabilization.

Four intensive facultative lagoon performance studies sponsored by the EPA were carried out at Peterborough, New Hampshire; Kilmichael, Mississippi; Eudora, Kansas; and Corinne, Utah. Criteria for optimum stabilization pond design were evaluated using data collected from the four sites along with data on organic loading and hydraulic detention time, empirical design equations, and rational design equations. The three models proposed proved inadequate as designs for facultative waste stabilization ponds. Often federal discharge standards were violated while the pond satisfied state orgnic loading and hydraulic detention time design criteria. The predictions yielded by the three empirical design equations and the two kinetic design models were not substantiated by published pond performance data. While the two kinetic models differed in their basic assumptions on the hydraulic flow patterns, neither described the measured performance. It was recommended that future research on pond performance consider the effect of physical and climatic conditions on hydraulic residence time. (Geiger-FRC)
W81-01809

AN INVESTIGATION OF THE INITIAL DILUTION OF SEWAGE DISCHARGED THROUGH SUBMARINE DIFFUSERS,
Techniche Eliminazione Inquinamenti, Milan (Italy).
P-G. Vigliani, B. Sclavi, R. Olivotti, A. Visconti, and G-F. Tartaglia.
Progress in Water Technology, Vol 12, No 1, p 321-337, 1980. 12 Fig, 1 Tab.

Descriptors: *Waste dilution, *Outfall sewers, *Diffusion, Mathematical models, Sewage, Nozzles, Salinity, On-site investigations, Europe, Sewage effluents.

The behavior and dilution of the dispersion plume of a domestic sewage source were investigated under various conditions, and several mathematical models were evaluated. Dilution was determined by measuring the salinity and the concentration of silicates within the plume. These values, together with the physical properties (velocity, temperature, etc.) were compared with values obtained using mathematical models. The procedure was repeated under varying conditions, including different diameters and directions of the discharge nozzle. The Cederwall formula was found to be the most suitable for predicting a safe value of initial dilution of a horizontally discharged jet, while the Cooley and Harris formula were simple and fairly accurate. The Rawn, Bowerman, and Brooks diagram gave unacceptably high results. The Fischer and Brooks diagram was useful for predicting the plume profile when the jets were in parallel. (Small-FRC)
W81-01810

SYNTHESIS OF WASTE TREATMENT SYSTEMS BY IMPLICIT ENUMERATION,
Environmental Protection Agency, Cincinnati, OH.
L. A. Rossman.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 148-160, January, 1980. 2 Fig, 10 Tab, 21 Ref.

Descriptors: *Computer models, *Designs, *Waste treatment, Model studies, Equations, Mathematical studies, Waste water treatment, Sludge treatment, Kinetics, Cost analysis, Structural analysis, Operations research, Simulation analysis.

The synthesis of waste water treatment systems involves specifying both the unit processes and operations as well as the design of the individual units within the structure. Ideally, models should integrate the designs of waste water and sludge treatment subsystems, select structure and design from a finite number of discrete alternatives, handle multiple pollutants or waste stream parameters, use principles of mass balance and reaction kinetics in predicting performance, evaluate costs and other systems criteria, and use a computationally efficient solution method. A new computer aided design procedure for waste treatment developed by the EPA is described. The method uses an implicit enumeration approach to select the combination of units that will best meet a set of design criteria from a list of unit process alternatives with fixed design specifications. The effect of return sidestream flows from sludge treatment units is approached by assigning representative penalty values to stream components which may be updated as new system designs are generated. Cost/energy-effectiveness analyses may be accomplished for design problems with over 15,000 alternate system configurations. The model presented is best applied in generating alternative system designs that emphasize different objectives to various degrees. (Geiger-FRC)
W81-01811

AUTOHEATED AEROBIC THERMOPHILIC DIGESTION WITH AERATION,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
W. J. Jewell, and R. M. Kabrick.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 512-523, March, 1980. 11 Fig, 2 Tab, 16 Ref.

Descriptors: *Aerobic treatment, *Aeration, *Heating, *Sludge treatment, Chemical oxygen demand, Biodegradation, Organic matter, Performance, Temperature, Equations.

A two-year project planned to demonstrate that a simple autoheated aerobic digestion process using full-scale equipment could be used to treat waste water sludge is presented. Mixtures of thickened waste, activated sludge and primary sludge were autoheated to temperatures in excess of 43C under all conditions for over a year. Self-aspirating aerators and well-insulated tanks in a full-scale reactor volume of 28.4 cu m were used; these had previ-

ously proven successful in treating animal wastes. Slurry temperatures exceeded 50C and reached a maximum of 63C. The reactors were easily started, and achieved temperatures in excess of 40C in about 10 days, even in cold weather. Maximum organic removal rates were obtained at loading rates between 8 and 10 kg of biodegradable COD/cu m - day. The equipment conserved heat of oxidation. An equation is given for calculating the potential for autoheating. The increase in temperature in degree C in the aerated slurry equals 2.4 times the COD in g/liter oxidized at hydraulic retention times less than 8 days. (Small-FRC)
W81-01812

DESIGN OF AN OVERLAND FLOW SYSTEM,
Brown and Caldwell, Walnut Creek, CA.
D. L. Tucker, and N. D. Vivado.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 559-567, March, 1980. 3 Fig, 1 Tab, 11 Ref.

Descriptors: *Septic tanks, *Overland flow, *Oxidation lagoons, Food processing industry, Industrial wastes, Agricultural watersheds, Biodegradation, Algae, *Waste water treatment, Design, Treatment facilities.

A design to upgrade the Newman Waste Water Treatment plant (California) is reviewed, with emphasis on the overland flow terrace system which is planned to remove algae from the oxidation pond effluent. Newman is an agricultural center with two milk processing and three vegetable packing plants. The facility includes septic tanks, followed by biological treatment in oxidation ponds. Increased industrial loadings in 1975 overloaded the system and caused several fish kills in the San Joaquin River. In the new system, septic tank effluent which currently flows in a ditch will be piped to an oxidation pond recirculation channel, where it will be mixed with recirculated pond water before being distributed to an aeration pond. Water will flow from the 5-acre aeration pond to the 50-acre oxidation pond. Oxidation pond effluent will flow through an effluent structure containing a chlorination injection and sampling facility, and then through a 30-minute contact chlorine chamber. Effluent will then be pumped to the overland terraces. (Small-FRC)
W81-01815

TOTAL NITROGEN REMOVAL IN A MULTI-CHANNEL OXIDATION SYSTEM,
Rexnord Inc., Milwaukee, WI.
C. S. Applegate, B. Wilder, and J. R. DeShaw.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 568-577, March, 1980. 4 Fig, 8 Tab, 14 Ref.

Descriptors: *Nitrogen, *Activated sludge, *Oxidation lagoons, Aeration, *Nitrogen removal, Oxygenation, *Waste water treatment, Nitrification, Ammonia, Organic matter, Treatment facilities, Performance.

An oxidation ditch/activated sludge plant was investigated to obtain baseline information on normal plant performance. Total nitrogen removal, up to 91%, was demonstrated by an endogenous nitrate respiration system. Very stable organic and nitrogen removals were obtained with no special operator attention. Plant effectiveness was due to several plant features, including multiple aeration channels in series. These allowed oxygen concentration control in each channel, permitting favorable conditions for the removal of carbonaceous material, ammonia oxidation, and nitrate reduction. Nitrogen removal was enhanced by splitting the feed to the first two aeration channels. Rotating disk aerators provided adequate channel mixing. Oxygen input was easily controlled by changing the number of disks or controlling disk submergence. Complete nitrogen removal allowed partial recovery of alkalinity and oxygen used for nitrification. Also, sludge flotation in the final clarifier was avoided. (Small-FRC)
W81-01816

REMOVAL OF ORGANIC SUBSTANCES BY BIOLOGICALLY ACTIVATED CARBON IN A FLUIDIZED-BED REACTOR,
McMaster Univ., Hamilton (Ontario). Dept. of Chemical Engineering.
M. Tsezos, and A. Benedek.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 578-586, March, 1980. 10 Fig, 4 Tab, 11 Ref.

Descriptors: *Adsorption, *Activated carbon, *Organic compounds, Performance, Sludge treatment, Waste treatment, Dissolved oxygen, Fluidized-bed reactor, *Waste water treatment.

Adsorbents which show promise for removing nondegradable organic substances generated during the treatment process were investigated. Batch adsorption isotherm tests on a bioresidual solution were used to evaluate F-1 activated alumina, XAD-4, XAD-7, XAD-8, Filtrasorb 400 activated carbon, Special A activated carbon, WRL 200 A anionic resin, and IRA 458 anionic resin. Continuous runs were performed in the fluidized-bed reactor system. All of the adsorbents except Filtrasorb 400 adsorbed only a fraction of the residual organics and indicated very low adsorptive capacities. Filtrasorb 400 adsorbed all of the biologically generated residual organics, and its maximum adsorptive power was more than 20 times higher than that of the other adsorbents tested. The volumetric yield of biofilm in an aerobic fluidized bed falls in the range of 0.8 to 2.9 cu cm/g total organic carbon oxidized. Inlet dissolved oxygen concentration had a strong positive effect on this yield. The level of inlet dissolved oxygen just sufficient for preventing anaerobiosis is recommended as a design optimum for fluidized bed bioreactors. (Small-FRC)
W81-01817

SCALEUP IN ROTATING BIOLOGICAL CONTACTOR DESIGN,
International Environmental Consultants Ltd., Toronto (Ontario).
R. W. Wilson, K. L. Murphy, and J. P. Stephenson.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 610-621, March, 1980. 8 Fig, 2 Tab, 19 Ref.

Descriptors: *Pilot plants, *Treatment facilities, *Design standards, *Waste water treatment, Biochemical oxygen demand, Nitrification, Temperature, Flow, Performance, Rotating biological contactors, Upgrading, Municipal wastes.

A scaleup plan and general design guidelines are presented for a rotating biological contactor (RBC) for treating municipal waste water. A pilot plant facility consisted of a coarse screen, grit tank, two primary clarifiers, three rotating biological contactors, and one secondary clarifier. During the scaleup evaluation, a 0.5 m unit was operated in parallel with the 2.0 m unit. Organic carbon removal rate decreased with increasing disk diameters at a given loading and media tip speed. There was little difference in the ability of the two RBC's to nitrify the waste water. For BOD removal, a surface area scaleup factor of 25% should be applied when designing a full-scale RBC system using 0.5 m RBC data. No scaleup factor is required for combined BOD removal plus nitrification. As part of a generalized design procedure, sample loadings that were derived from test data from the 2.0 m pilot RBC are presented in a table. Factors considered in developing these loadings were: scaleup factor, temperature effects, and natural diel variations in waste water flow and strength. (Small-FRC)
W81-01820

CURRENT STATUS OF WATER RECLAMATION AT WINDHOEK,
National Inst. for Water Research, Pretoria (South Africa).
L. R. J. van Vuuren, A. J. Clayton, and D. C. van der Post.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 661-671, April, 1980. 8 Fig, 8 Tab, 2 Ref.

Descriptors: *Water reuse, *Effluents, *Costs, Lime, Ammonia, Activated carbon, Adsorption, *Treatment facilities, Potable water, Chlorination, South Africa, *Windhoek(South Africa).

The Windhoek water reclamation plant (WRP I) was designed for the reclamation of water from maturation ponds that serve as polishing stages for secondary effluent discharged by upstream conventional waste treatment facilities. The plant was originally opened in 1963; by 1973 modifications were needed to continue water reclamation. The plant was modified to include high-lime treatment, ammonia stripping, improved activated carbon adsorption capacity, and carbon regeneration. The utilization duration of the facility improved to 10 months/year. After modification, the chemical, biochemical, and microbiological quality was highly satisfactory. The cost of reclaimed water was approximately $0.32/cu m as compared with $0.21/cu m for other sources in the area. The cost was dependent on chlorination demand, with associated ammonia concentration in the feed water. Currently, additions to the facility are planned which will provide for biological denitrification and phosphate removal. (Small-FRC)
W81-01822

ON-SITE WASTE WATER TREATMENT ON PROBLEM SOILS,
Minnesota Pollution Control Agency, Roseville.
M. J. Hansel, and R. E. Machmeier.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 548-558, March, 1980. 7 Fig, 1 Tab, 34 Ref.

Descriptors: Regulation, *Septic tanks, *Domestic wastes, Percolation, Permeability, Soil water movement, Design, Treatment facilities, Trenches, *Soil types, Performance, Minnesota, *Waste water treatment, Soil properties.

The development of standards for on-site systems for both suitable and problem soils are discussed, and specific design criteria are presented for four problem soil conditions. The Minnesota Pollution Control Agency began developing standards for the design, location, construction, and maintenance of on-site systems in 1974. By 1977, when the standards went to formal public hearings, over 1000 residents knew the technical details of the standards. It is necessary to have 0.9 m of unsaturated soil for proper treatment of waste water. Drain-field trenches are effective for normal soil treatment systems. Problem soils require different approaches. Rapidly permeable soils may require a trench lined with less permeable soil to aid in the formation of a biological mat. Slowly permeable soils require a mound system, and the sides of the trench must be raked or scarified. For high groundwater table or bedrock, there are many systems that can be installed a little higher than usual, which will give satisfactory results. Also, the groundwater can be lowered artificially. The mound system, which locates treatment above the original ground in elevated fill, is the solution to many problem locations. (Small-FRC)
W81-01824

POWDERED VERSUS GRANULAR CARBON FOR OIL REFINERY WASTE WATER TREATMENT,
Amoco Oil Co., Naperville, IL.
C. G. Grieves, L. W. Crame, D. G. Venardos, and W-C. Ying.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 483-497, March, 1980. 14 Fig, 9 Tab, 15 Ref.

Descriptors: *Activated sludge, *Oil wastes, *Activated carbon, Performance, Particle size, Costs, *Waste water treatment, Industrial wastes.

Powdered activated carbon (PAC) addition to activated sludge for the treatment of oil refinery waste water was evaluated at Amoco's Texas City, Texas, plant; at the Wood River Refinery; and in bench tests. Variables investigated were: degree of pretreatment, sludge age, PAC characteristics, PAC dose, and level of PAC in activated sludge

mixed liquor. PAC-enhanced sludge systems were successfully operated for extended periods at very high sludge ages (100 days) when optimum pretreatment was used. Systems can produce effluents with quality comparable to that of tertiary treatment by granular carbon adsorption. The PAC system was generally more cost effective than granular carbon systems. If high-surface-area carbon were available commercially, cost effectiveness would be even higher. Several questions remained to be answered about the process. For example, effluent variability and removal of nonconventional and priority pollutants from waste waters are topics which must be investigated. (Small-FRC)
W81-01825

WASTE WATER TREATMENT WORKS IN JAPAN: STATUS AND OUTLOOK,
Ministry of Construction, Tokyo (Japan). Sewage Works Div.
T. Tamaki.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 862-872, May, 1980. 3 Fig, 2 Tab.

Descriptors: *Sewerage, *Legislation, *Comprehensive planning, Treatment facilities, Construction, Standards, Water quality, *Japan, *Waste water treatment.

The history of sewerage in Japan, the current situation in waste water treatment, and the future are discussed. Waste water treatment was not a problem in Japan until recently because of widespread agricultural disposal and swift running rivers which emptied into the sea. Waste water treatment plants were required to comply with water quality standards with the passing of the Water Pollution Control Law in 1970. The most recent Sewerage Law required comprehensive basin-wide planning of sewerage systems, required the public to convert to sewerage within three years when it was available, and required effluent from factories and treatment plants to meet government standards. Five year sewerage construction plans are reviewed. Japan is studying control and treatment methods used in other countries and selecting and implementing those best suited for Japan's situation. (Small-FRC)
W81-01826

ANAEROBIC TOXICITY EVALUATION BY BATCH AND SEMI-CONTINUOUS ASSAYS,
Stanford Univ., CA. Dept. of Civil Engineering.
D. C. Stuckey, W. F. Owen, P. L. McCarty, and G. F. Parkin.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 720-729, April, 1980. 7 Fig, 4 Tab, 10 Ref.

Descriptors: *Anaerobic digestion, *Toxins, *Bioassay, *Chlorides, *Sludge, Toxicity, Vinyl chloride, Methylene chloride, Ethylene dichloride, Vinyl acetate.

Both batch and semi-continuous feed bioassays were evaluated as methods to determine the toxic effects of four organic materials on anaerobic digestion. Biological assay procedures offer promise in determining the causes of digester failure. Semi-continuous bioassays were conducted using continuously stirred 1.5 liter digesters operated at a 15-day detention time and a temperature of 35 degrees C. Batch bioassays were conducted using flasks or bottles containing 30 ml of a nutrient and buffer solution, 20 ml of sludge from a laboratory digester, and 0.100 ml of ethanol to serve as a substrate. The toxic effects of methylene chloride (MC), vinyl chloride (VC), ethylene dichloride (EDC), and vinyl acetate (VA) were studied. Using batch assay, the toxicity thresholds were: less than 3.16 mg/liter for MC, between 200 and 400 mg/liter for VA, about 2.5 mg/liter for EDC, and between 5 and 10 mg/liter for VC. Using semi-continuous assay, the toxicity thresholds were: 1.8 mg/liter for MC, 1200 mg/liter for VA, 5-7 mg/liter for EDC, and more than 64 mg/liter for VC. Batch systems measured the toxicity threshold of a slug dose and thus usually gave a conservative figure. Advantages of this method were low cost, speed, and high reproducibility. Semi-continuous assays cost more, take more time, and are less reproducible, but give a better indication of inhibitory effects. (Small-FRC)
W81-01827

COST OF WATER RECLAMATION BY ADVANCED WASTE WATER TREATMENT,
Orange County Water District, Fountain Valley, CA.
D. G. Argo.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 750-759, April, 1980. 3 Fig, 11 Tab.

Descriptors: *Costs, *Water reuse, *Treatment facilities, Capital costs, *Waste water treatment, Reclaimed water, Water conservation, California, Operating costs, Maintenance costs, *Orange County Water District(CA).

Cost data are presented for the Orange County Water District's Water Factory 21, a facility which can act as a model for water reuse projects. The advanced waste water treatment processes used at Water Factory 21 include lime clarification with sludge recalcination, ammonia stripping, recarbonation, breakpoint chlorination, mixed-media filtration, activated carbon adsorption with carbon regeneration, reverse osmosis demineralization, and postchlorination. The capital cost is $60/1000 cu m, and the operation and maintenance cost is $84/1000 cu m. The capital cost of reverse osmosis is $45/1000 cu m, and the operation and maintenance cost is $118/1000 cu m. Thus, the total cost of the blended water produced by Water Factory 21 is $90/1000 cu m capital and $131/1000 cu m operation and maintenance. Research is being conducted currently to reduce these costs. At current prices, reclaimed water is cheaper than imported water in Southern California. (Small-FRC)
W81-01829

EFFECTS OF WATER CONSERVATION ON MUNICIPAL WASTE WATER TREATMENT FACILITIES,
Association of Bay Area Governments, Berkeley, CA.
J. A. Davis, and T. A. Bursztynsky.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 730-739, April, 1980. 2 Fig, 3 Tab, 5 Ref.

Descriptors: *Treatment facilities, *Water conservation, *Municipal wastes, Low flow, California, *Waste water treatment, Evaluation.

The extent of flow reduction to be expected after implementation of water conservation practices in the San Francisco Bay Area and the effects of the reduction on waste water treatment facilities were examined. While the volume of waste water will be reduced by low-flush toilets, low-flow shower heads, hot water pipe insulation, etc., the volume of pollutants in the waste water will not be reduced. Problems which may result from reduced flow are excess organic deposition in grit chambers, determination of new chemical doses required, and reduced hydraulic head-loss. Trickling filters, sewers, sedimentation basins, and activated sludge systems will not be affected adversely. The 10 to 20% expected reduction in flow will probably result in some extension in the length of time before facilities become overloaded. New facilities should cost less if the water conservation continues. The performance of biological reactors may have to be improved, but overall effects of the conservation problem will be minor. (Small-FRC)
W81-01831

SEPTIC SYSTEM PROBLEMS ON AN URBAN FRINGE,
New Castle County Areawide Waste Treatment, Newark, DE.
D. R. Goehring, and F. R. Carr.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 89-102, March, 1980. 3 Fig, 3 Tab.

Descriptors: *Septic tanks, *Domestic wastes, *Urbanization, Sewers, Planning, Waste water treatment, Water quality control, Costs, Groundwater, Suburban areas, Utilities, Delaware, *New Castle County(DE).

Water quality and public policy problems associated with the use of septic systems in New Castle County (Delaware) are discussed, and solutions to some of these problems are reviewed. Septic systems are needed in areas where public sewers would be prohibitively expensive. Land use and public policy decisions can make the high costs of treating waste water even higher. Conventional cost-effectiveness logic can not be applied to existing waste water treatment alternatives without considering the costs of groundwater pollution in determining future land use and waste water treatment needs. The beneficiaries of septic system use must bear the responsibility of correcting the problem, not the general public. When the costs to homeowners of installing public sewers are high, septic tank usage is encouraged. When setting public policy on septic systems, total water quality management goals must be considered. (Small-FRC)
W81-01836

TOXIC INHIBITION OF ANAEROBIC BIODEGRATION,
California Univ., Berkeley. Sanitary Engineering Research Lab.
F. Pearson, C. Shiun-Chung, and M. Gautier.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 472-482, March, 1980. 7 Fig, 1 Tab, 10 Ref.

Descriptors: *Anaerobic treatment, *Recreation wastes, *Toxins, Inhibitors, Tourism, Zinc, Phenols, Retardants, Rates, Recreational vehicle wastes, Rest room rates.

Waste water discharged at highway comfort stations and RV dump stations was characterized, and the degree of anaerobic biodegradation inhibition by toxins in RV waste was evaluated. RV black water, RV gray water, mixed RV black water and gray water, and rest room wastes were analyzed and evaluated for content of four toxicants: formaldehyde, zinc sulfate, phenol, and quaternary ammonium-based proprietary product. The effects of time and toxicant concentration under shock loading on anaerobic gasification rate were determined in laboratory tests. Half-kill doses were established for shock loading (acclimation loading) as follows: formaldehyde - 200 mg/liter, zinc sulfate - 400 mg Zn/liter, phenol - 500 mg/liter, and quaternary ammonium compound - 50 mg organic N/liter. At the concentrations of formaldehyde, zinc sulfate, and quaternary ammonium compounds in RV wastes caused by preservative chemicals added for odor control, the rate of anaerobic degradation may be on the order of one-third to one-half that for toxicant-free anaerobic biodegradation. RV black water typically contained 15,000 mg COD/liter and 7500 mg suspended solids/liter, while gray water and rest room wastes were marginally stronger than domestic waste water. (Small-FRC)
W81-01845

AN ENZYMATIC PRETREATMENT TO ENHANCE THE LIME PRECIPITABILITY OF PULP MILL EFFLUENTS,
Institute of Paper Chemistry, Appleton, WI.
R. L. Schmidt, and T. W. Joyce.
Tappi, Vol 63, No 12, p 63-67, December, 1980. 2 Fig, 4 Tab, 12 Ref.

Descriptors: *Pulp wastes, *Waste water treatment, *Enzymes, Horseradish peroxidase, Chemical precipitation, Pulp and paper industries, Organic wastes, Wood wastes, Catalysts, Polymers, Effluents, Industrial wastes.

Laboratory studies revealed that pretreatment of pulp mill effluents with the enzyme, horseradish peroxidase, polymerized low molecular weight color bodies. Subsequent lime precipitation improved color removal by a factor of 50% relative to conventional lime treatment. Molecular weight distributions of color bodies in effluent treated with horseradish peroxidase and hydrogen perox-

ide contained 8% more high molecular weight material than in the treatment with peroxidase alone. A test using inactive horseradish peroxidase versus active peroxidase, both with hydrogen peroxide, showed that although inactive proteins did slightly improve precipitability of color bodies by lime, it was the enzyme effect which accounted for a 30-34% improvement relative to controls. An excess of hydrogen peroxide had a degrading effect on the color bodies, but it had in limited amounts a polymerizing effect. (Cassar-FRC)
W81-01848

BACTERIA CAN SOLVE MALODOURS AND GREASE PROBLEMS IN TREATMENT PLANTS.
Water and Pollution Control, Vol 118, No 12, p 17, December, 1980.

Descriptors: *Bacteria, *Sewage treatment, *Organic wastes, Operation and maintenance, *Grease, *Odor control, Ponds, Activated sludge, Citizens utility, Maintenance, Treatment facilities, Waste treatment, Treatment, Algae.

A company which handles treatment of waste water for several Illinois communities uses a dried bacteria formulation to control odors and grease, for example in an activated sludge polishing pond. Planned addition of these facultative anaerobes maintains dominance of introduced species over the indigenous bacteria. Undesirable side effects, all of which are easily handled, include foaming in tanks, algae bloom, and duckweed accumulation. Maintenance costs are reduced because pumps and sewer lines require less cleaning and repairs. During closedowns and phaseouts of treatment facilities, odors are prevented by adding about 60 pounds of bacteria formulation. (Cassar-FRC)
W81-01849

THE EFFECT OF ALUMINIUM AND FERRIC IONS ON THE ELECTROPHORETIC MOBILITY OF PARTICLES IN TREATED PIGGERY EFFLUENTS,
University Coll. of Swansea (Wales). Dept. of Chemical Engineering.
S. T. Thuraisingham, J. A. Howell, and D. J. A. Williams.
Water Research, Vol 14, No 9, p 1209-1213, September, 1980. 4 Fig, 25 Ref.

Descriptors: *Waste water treatment, *Farm wastes, *Coagulation, Aluminum, Iron compounds, Electrical properties, *Electrophoresis, Colloids, Separation techniques, Pig breeding, Aging(Biological).

Electrokinetic properties are reported for pig slurry particles in the clarified effluent following aerobic treatment. Hydrolyzable cations such as aluminum and ferric ions caused charge reversal of the negatively charged colloidal particles in freshly aerated pig effluent. This in turn changed the isoelectric point (IEP) of these particles. When pig effluent had been left standing for more than 15-20 days, no charge reversal occurred at ferric chloride concentrations less than 0.001 and at concentrations of aluminum sulfate between 0.01 and 0.0001 M. Colloidal particles coagulate best in the vicinity of their IEP. By adding hydrolyzed cation at the appropriate pH, charge neutralization can be achieved. Thus it is possible to coagulate pig slurry particles in freshly aerated effluent over a controlled pH with small amounts of electrolytes. Pig effluent should be freshly aerated immediately prior to chemical treatment to enable the coagulation to occur with low dosages of the coagulants. (Baker-FRC)
W81-01852

A QUANTITATIVE INVESTIGATION OF THE REACTION OF OZONE WITH P-TOLUENESULFONIC ACID IN AQUEOUS SOLUTION AS A MODEL COMPOUND FOR ANIONIC DETERGENTS,
Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F. R.).
P. Joy, E. Gilbert, and S. H. Eberle.
Water Research, Vol 14, No 10, p 1509-1516, October, 1980. 10 Fig, 6 Tab, 14 Ref.

Descriptors: *Biodegradation, *Ozone, *Surfactants, Water treatment, Oxidation, p-Toluenesulfonic acid, Model studies, Chemistry, Organic compounds.

The reaction of p-toluenesulfonic acid (PTA) with ozone was studied at initial levels of pH 3 and 12 in aqueous solutions. The initial concentration of PTA was 1 mmol/l. The substrate elimination followed a zero order rate law. A 98% reduction in PTA required at least 7 mol ozone/mol PTA. To remove all the PTA the consumption of ozone increased to 16 mmol/mmol PTA. A 28% reduction in DOC and 74% reduction of COD resulted at this concentration of ozone. At higher ozone flow rates the PTA decomposition was quicker. However, the specific ozone consumption also increased. Methylglyoxal, acetic acid, formic acid, pyruvic acid, oxalic acid, sulfuric acid and hydrogen peroxide were identified as oxidation products. Mesoxalic acid was identified as a byproduct. Lactic acid was a further oxidation product at pH 12. A possible reaction mechanism is described, which suggests that ozone treatment can be used to enhance degradation of nonbiodegradable organics. (Baker-FRC)
W81-01853

THE INFLUENCE OF SLUDGE AGE ON HEAVY METAL REMOVAL IN THE ACTIVATED SLUDGE PROCESS,
Imperial Coll. of Science and Technology, London (England). Dept. of Public Health Engineering.
R. M. Sterritt, and J. N. Lester.
Water Research, Vol 15, No 1, p 59-65, January, 1981. 5 Fig, 1 Tab, 29 Ref.

Descriptors: *Heavy metals, *Activated sludge, Biochemical oxygen demand, Sludge, Trace elements, Metals, Suspended solids, Effluent, *Sewage treatment, Water pollution.

A laboratory simulation of the activated sludge process was conducted to determine the influence of sludge age on heavy metals removal. Ten metals were added continuously to 6 sludge samples with ages between 3 and 18 days. Results demonstrated differences in the behavior of heavy metals which may be attributable to various factors, including affinity for solids, soluble complexing agents, and chemical oxygen demand. The highest removal efficiencies for most metals occurred at the 15 day sludge age. Cobalt, manganese, and molybdenum removals were poor; chromium and cadmium removals were consistently highest, with efficiencies greater than 50%. (Titus-FRC)
W81-01854

THE INACTIVATION OF FAECAL COLIFORMS AND ASCARIS OVA IN FAECES BY LIME,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Environmental Engineering.
C. Polprasert, and L. G. Valencia.
Water Research, Vol 15, No 1, p 31-36, 1981. 4 Fig, 2 Tab, 21 Ref.

Descriptors: *Sewage bacteria, *Worms, *Lime, Microorganisms, *Coliforms, *Water treatment, Calcium compounds, Sampling, Oxides, Hydrolysis, Chemical degradation, Fertilizer, Sludge, *Thailand.

The inactivating effect of lime on fecal microorganisms was investigated during a pilot project in Thailand. Human fecal samples were dosed with lime slurry and analyzed over a 48 hour period for pH, coliforms, and the presence of Ascaris ova. Results indicate that in sufficient quantities lime can be effective in inactivating coliforms. Insignificant effects are observed with a pH of 9. In all cases the contact time of 3 hours was sufficient. Results indicate ovicidal effects on Ascaris at a low efficiency. The application of lime as a disinfectant may be a useful, low-cost method of reducing disease in developing countries. (Titus-FRC)
W81-01855

BIOLOGICAL DENITRIFICATION IN AN UPFLOW SLUDGE BLANKET REACTOR,
Agricultural Univ., Wageningen (Netherlands).
K. Klapwijk, J. C. M. van der Hoeven, and G. Lettinga.
Water Research, Vol 15, No 1, p 1-6, January, 1981. 4 Fig, 4 Tab, 16 Ref.

Descriptors: *Sludge treatment, *Nitrates, *Dentrification, Solids contact processes, Flow, *Nutrient removal, Waste treatment, Activated sludge, Biodegradation, Sands, particle size, Velocity, Sewage effluents, Suspended solids.

Upflow sludge blanket reactors with no carrier medium can be used for nitrate removal. Studies using fusel oil surface loading of 2 meters/hectare produced sludge concentrations of 40 grams of total solids per liter. Higher loads are believed to be attainable. The minimum nitrate removal rate obtained was 500 grams per cubic meter per hectare. The sludge blanket reactor requires no effluent recycling. In addition, it reduces the escape of suspended solids and carrier particles because it fluidizes sludges at lower velocities than conventional sand bed reactors. (Titus-FRC)
W81-01858

A COMPARISON OF THE CHARACTERISTICS OF SOLUBLE ORGANIC NITROGEN IN UNTREATED AND ACTIVATED SLUDGE TREATED WASTE WATERS,
Drexel Univ., Philadelphia, PA. Dept. of Civil Engineering.
G. F. Parkin, and P. L. McCarty.
Water Research, Vol 15, No 1, p 139-149, January, 1981. 5 Fig, 5 Tab, 36 Ref.

Descriptors: *Waste water treatment, *Nitrogen compounds, *Activated sludge, Biological treatment, Organic compounds, Chemical oxygen demand, Hydrogen ion concentration, Adsorption, Activated carbon, Separation techniques, Cation exchange, Chromatography, Amino acids, Anion exchange.

The characteristics of soluble organic materials containing nitrogen (SON) in untreated waste waters and activated sludge effluents were studied using low microbial seed biodegradation evaluation, filtration chromatography for molecular weight distribution, activated carbon and ion exchange to determine removal, and analyses for free and combined amino acids. Activated sludge effluent SON was more refractory than untreated waste water SON. SON produced biologically during treatment had decay rates that were similar to those of SON in municipal activated sludge effluents and was 20-100% refractory. Less than 10% of the SON in municipal activated sludge effluent was made up of free or combined amino acids. About 15-30% were thought to be nucleic acid degradation products. Of the SON and soluble chemical oxygen demand (SCOD), 50-60% had apparent molecular weights (AMP) of less than 1800. Treated and untreated waste waters had similar AMP. The excess SON generated during activated sludge start-up contained considerably more SON with molecular weights greater than 1800. SON and SCOD were efficiently adsorbed from treated and untreated waste waters and from biologically produced organics by activated carbon. A significantly greater amount of SON was removed by cationic exchange from all waste waters tested at pH 2.0 than at pH 9.5. At pH 2.0, cationic exchange selectively removed more biologically produced SON relative to SCOD. (Geiger-FRC)
W81-01862

RESOLUTION OF AN INDUSTRIAL WASTE DILEMMA,
Quicksall (W. E.) and Associates, Inc., New Philadelphia, OH.
For primary bibliographic entry see Field 5C.
W81-01879

CONTROLLING AMMONIA IN WASTE WATER EFFLUENTS: A DISCUSSION,
Metropolitan Sanitary District, Chicago, IL.

W. L. Munch.
Public Works, Vol 111, No 6, p 140-142, June, 1980. 3 Ref.

Descriptors: *Ammonia, *Waste water treatment, Nitrification, Sludge treatment, Nitrogen compounds, Retention time, Evaluation.

This article makes reference to a previous publication dealing with the theoretical aspects of biological nitrification. The current author cites confusion arising out of the incorrect usage of the terms 'solids retention time' and 'solids wasting rate'. The current author states that wasting rates should not be kept as low as possible, but should be rationally determined based on a target solids retention time which reflects the various conditions of the system. Sludge wasting rates must be high enough to maintain MLSS concentration within the solids handling capacity of the clarifiers. The solids retention time should also be selected so that it is the lowest which will safely sustain nitrification under the most severe anticipated conditions. The author states that in order to control nitrification processes, especially single-stage ones, a full understanding of their requirements and potential problems is necessary. (Baker-FRC)
W81-01881

A CASE STUDY OF COMPUTERIZED INDUSTRIAL WASTE DATA,
Metropolitan District Commission, Boston, MA. Sewerage Div.
For primary bibliographic entry see Field 7C.
W81-01887

DRAINAGE BASIN CONTAMINATION PROMPTS REGIONAL PLANNING,
CH2M/HILL, Redding, CA.
S. A. Smith, and C. D. Gardner.
Public Works, Vol 111, No 5, p 76-77, 130, May, 1980. 2 Tab.

Descriptors: *Regional planning, *Water pollution control, *Earthquake engineering, *Treatment facilities, *Sewage treatment, Oroville, Thermalito, North Burbank(CA), California, Waste water treatment, Feather River(CA), Salmon, Fish, Municipal wastes, Construction costs, Sewage effluents.

Pollution problems in the Feather River, California, were solved after a sewage treatment plant was designed and built by the Sewerage Commission Oroville Region (SCOR), composed of 3 communities, Oroville, North Burbank, and Thermalito. Total construction costs were $7.4 million. Much of the existing facility at Oroville was incorporated into the new plant. The structure was designed to be earthquake resistant and has resisted quakes registering 7.5 and hundreds of aftershocks. The Feather River salmon population is protected from pollution by discharging treated effluent 5 miles below spawning grounds. Fingerling trout are used to monitor the toxicity of the effluent. An emergency storage pond with capacity for 2 days' flow is available for excess flows or emergencies. Operation and maintenance costs for the 1978-1979 fiscal year were $259,000, equal to 30 cents per thousand gallons. (Cassar-FRC)
W81-01889

EXPERIMENTAL LAND TREATMENT SYSTEM PROCESSES MINE DRAINAGE.
Public Works, Vol 111, No 2, p 91, February, 1980.

Descriptors: *Acid mine water, *Coal mine wastes, *Lime, *Waste water treatment, Water pollution sources, Acid streams, Water pollution, Mine drainage, Mine wastes, Filtration, Hydrogen ion concentration, Streams, Watersheds, Pennsylvania, Iron, Appalachian Mountain region.

In Appalachian Pennsylvania, where acid mine drainage has destroyed the biological activity of many streams, research is being conducted on a low cost system to treat acid mine drainage before returning it to the watershed. The Loyalhanna Watershed Association is using lime treated forest soil to remove dissolved iron and sulfuric acid from water flowing out of an abandoned coal mine which has been polluting Laurel Run, a tributary of Loyalhanna Creek. Lime treatment is performed in three earthen lagoons covering a half acre plot. The living filter principle is applied as limed soil treatment, wherein soil microorganisms act to cleanse the wastes before the water is returned to the main stream. Mixed results have been reported for the project so far. While level of iron in the mine drainage has been reduced, no significant decreases in pH values have been observed. To help decrease the pH of the mine drainage stream, less water will be released into the treatment lagoons, and the amount of lime used will be increased. (Geiger-FRC)
W81-01897

5E. Ultimate Disposal Of Wastes

EFFECTS OF ENVIRONMENTAL VARIABLES AND SOIL CHARACTERISTICS ON VIRUS SURVIVAL IN SOIL,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
For primary bibliographic entry see Field 5B.
W81-01771

ENGINEERING EVALUATION OF NEW SLUDGE TREATMENT FACILITIES,
Japan Sewage Works Agency, Saitama. Research and Technology Development Div.
K. Ohmiya, and S. Takahashi.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 943-949, May, 1980. 4 Fig, 6 Tab.

Descriptors: *Sludge treatment, *Treatment facilities, Evaluation, Technology, Heating, Incineration, Dewatering, Sludge disposal, *Japan, Steam-heated screw press, Carver-Greenfield process.

New facilities and equipment related to sludge treatment that have recently been put on the market in Japan are evaluated. A steam-heated screw press has been installed at a dewatering plant. Conditioned sludge is dewatered and gradually compressed by a screw turning at 0.1 to 0.2 rev/min and further compressed by a compression ring. The steam heats the sludge to 40 to 70 degrees C, and quicklime is used as a coagulant. Various process parameters are given, and a disadvantage of the new system, odor of heated sludge, is explained. The Carver-Greenfield process, which uses triple-effect evaporators to dewater sludge and a boiler to incinerate dry sludge, is described. This process has lower operating and capital costs compared to conventional systems. A pilot-scale smelting furnace plant heated with an oil burner has been developed which is capable of processing sludge cake at a rate of about 800 kg/hour. Because the slag can be used as a filler like sand in sewer construction, this new method has gained attention. (Small-FRC)
W81-01796

SETTLING PROPERTIES OF EXTENDED AERATION SLUDGE,
Department of Health, Johannesburg (South Africa).
A. R. Pitman.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 524-536, March, 1980. 12 Fig, 5 Tab, 21 Ref.

Descriptors: *Sludge, *Settling velocity, *Suspended solids, *Activated sludge, Aeration, Dissolved oxygen, Nutrients, Nutrient removal.

The settling properties of activated sludges from two extended aeration plants and an activated sludge plant designed for biological nutrient removal were investigated. An apparatus was developed to measure settling properties using multiple batch settling tests. The relationship between sludge settling velocity and solids concentration followed a straight line on log-log graph paper. The results of this investigation can be used to optimize plant operation. Well-operated extended aeration activated sludge plants running at long sludge ages (15 to 20 days) can produce sludges with settling properties comparable to those of pure oxygen plants. Dissolved oxygen levels can not be allowed to drop to levels where filamentous growth is favored. Operation of a biological nutrient removal activated sludge plant risks the occurrence of slow-settling filamentous sludges, especially when the non-aerated zones make up a large proportion, more than 20%, of the main tank volume, and dissolved oxygen levels are suppressed. (Small-FRC)
W81-01813

ENERGY AUTONOMY IN THE WASTE WATER TREATMENT PROCESS,
Societe Degremont, Rueil-Malmaison (France).
J. Bernard, and P. DaVia.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 587-596, March, 1980. 6 Fig, 6 Tab.

Descriptors: *Energy, Conservation, *Treatment facilities, Anaerobic digestion, *Sludge disposal, Incineration, Costs.

Energy recovery in waste water treatment plants is discussed. Energy recovery is possible through anaerobic digestion of sludge and sludge incineration. Electromechanical recovery during anaerobic digestion can be achieved by means of intermediate internal combustion dual-fuel-type engines. While the output of the dual engines is relatively low, 30-40% of the energy spent can be recovered in the form of hot water from the cooling circuits and exhaust gas. The real output of energy transformation is actually about 50%. When fresh sludge is to be disposed of by incineration, the best energy recovery is obtained when the sludge is dewatered. Currently, energy recovery costs almost as much as buying energy. However, this may change as energy deficiencies grow. Also, an energy autonomous plant has the advantage of being independent of energy sources and may be located without regard to these sources. (Small-FRC)
W81-01818

SOLIDS HANDLING SYSTEMS FOR SIX DIFFERENT DISPOSAL OPTIONS,
Metropolitan Sanitary District of Greater Chicago, IL. Maintenance and Operations Dept.
R. R. Rimkus, E. W. Knight, and G. E. Sernel.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 740-749, April, 1980. 2 Fig, 7 Tab, 5 Ref.

Descriptors: *Sludge disposal, *Fertilizers, *Costs, Illinois, Cities, Drying, Land reclamation, Sludge digestion, Sewage sludge, Composting, *Solid waste disposal.

Six solids disposal management options practiced by the Metropolitan Sanitary District of Greater Chicago are reviewed. Nu Earth, a waste water solid that has been digested anaerobically and air dried for several years, is given away by the truckload. Nu Earth is compost-like material resembling rich soil and is acceptable for flower and landscape gardening. Heat-dried fertilizer, an excellent soil conditioner, is sold to a broker by competitive bid. Waste activated solids are conditioned with ferric chloride, dewatered by vacuum filters, mixed with dry solids, and heated to approximately 700C to produce the fertilizer. Some waste solids are digested in heated anaerobic digesters for 14 days and applied to land which was previously stripmined. Other waste solids are aged in lagoons after heated digestion and then distributed free to the public or disposed of by a contractor. Since 1977, some solid wastes have been composted as part of a research program. Fertilizer production, land reclamation, and composting are the most costly of the six methods studied. (Small-FRC)
W81-01830

ALTERNATIVE FUELS FOR MULTIPLE-HEARTH FURNACES,
Brown and Caldwell, Walnut Creek, CA.
B. D. Bracken, and T. U. Lawson.

Journal of the Water Pollution Control Federation, Vol 52, No 4, p 791-803, April, 1980. 4 Fig, 9 Tab, 7 Ref.

Descriptors: *Energy, *Cost-benefit analysis, *Fuels, *Sludge treatment, Feasibility studies, Dewatering, Incineration, Alternative fuels, Energy conservation, Australia.

The reduction or elimination of fuel oil requirements for multiple hearth furnaces at the Lower Molonglo Water Quality Control Centre (Australian Capital Territory near Canberra) was investigated. The furnaces are used to effect sludge volume reduction and recover lime for reuse in the treatment process. It was technically feasible to fire refuse-derived fuel, waste paper, wood chips, or coal in the furnaces as a partial or total substitute for fuel oil (No. 2). Also, fuel oil consumption could be minimized by reducing sludge water content by either dewatering sludge in filter press or drying it with a rotary drier using furnace offgases. Either using a waste fuel or reducing sludge moisture will require modifications to the plant, and for some waste fuels, the construction of additional waste processing facilities would be necessary. The costs of the additional required facilities would offset any potential savings in fuel costs. A cost analysis indicated that none of the solid-fuel alternative schemes would be cost effective in comparison with the existing fuel-oil fired operation through 1989. A sludge drying operation would be cost effective by 1985 if afterburning was not required. (Small-FRC)
W81-01832

SINGLE-SLUDGE PURE-OXYGEN NITRIFICATION AND PHOSPHORUS REMOVAL,
Calocerinos and Spina, Syracuse, NY.
R. A. Clarkson, P. J. Lau, and D. J. Krichten.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 770-779, April, 1980. 6 Fig, 7 Tab, 6 Ref.

Descriptors: *Nitrification, *Sludge treatment, *Phosphorus removal, Performance, Biochemical oxygen demand, Lime, Ferric chloride, Alum polishing.

A pilot-plant program to obtain design criteria for single-sludge, pure-oxygen nitrification and compatible methods of oxygen removal is reviewed. The Morgan Road pilot plant study (Morgan Road Treatment Plant in Onondaga County, New York) had two phases. Phase I investigated FeCl2 and lime addition to primary and oxygen activated sludge nitrification. Phase II investigated oxygen activated sludge nitrification and alum polishing. Total system performance was 95% or greater for the removal of BOD5, NH3-N, and total suspended solids for all steady-state periods. Final effluent total phosphorus concentrations were maintained at less than 1.0 mg/liter over the same period. Over 90% of the BOD and NH3-N were removed by the nitrification system with a 2-hour influent detention time, at 20 and 13 degrees C, and after primary clarification with lime and ferric chloride. The nitrification system was successful in removing over 90% of the BOD and NH3-N with a 4-hour detention time at 13 degrees C when treating raw degritted waste water. Phosphorus was removed to less than 1 mg/liter by ferric chloride and lime addition before the primary clarifier. The lime was found to both buffer the nitrification system pH and remove phosphorus to an extent that minimized the dosage of ferric chloride required. (Small-FRC)
W81-01834

COMPOSTING AND DISPOSAL OF INDUSTRIAL WASTE WATER SLUDGE,
Alexander Potter Associates, New York.
P. A. Nese, J. Galandak, and J. A. Frederick.
Journal of the Water Pollution Control Federation, Vol 52, No 1, p 183-191, January, 1980. 1 Fig, 8 Tab, 1 Ref.

Descriptors: *Sludge treatment, *Biodegradation, *Soil disposal fields, *Sludge disposal, Industrial wastes, Heavy metals, Costs, Regulation, Performance.

A sludge management plan for the highly industrialized northern New Jersey area includes composting of the sludge and deposit on non-agricultural lands. As an alternative to the now illegal ocean dumping, sludge composting has the lowest capital and operating costs, and it satisfies the EPA requirement that beneficial use be given preference. However, the sludge includes heavy metals from industrial sources which make beneficial use difficult. For example, existing sludge contains 4332 mg/kg of zinc, while the NJDEP limit is 2500 mg/kg. An 18-day sampling program also found excessive levels of copper, nickel, cadmium, and chromium. Pyrolysis and land application were considered as alternatives to ocean dumping, but composting with the addition of wood chips to dilute the heavy metals was the most attractive alternative. A study is needed to see if the resulting composted product could be marketed, as similar compost is in several locations. The high heavy metal concentrations may eliminate this possibility. (Small-FRC)
W81-01842

DEVELOPING A COST-EFFECTIVE SLUDGE MANAGEMENT APPROACH,
Proctor-Davis-Ray, Inc., Lexington, KY.
C. R. Scroggin, D. A. Lewis, and P. B. Danheiser.
Public Works, Vol 111, No 6, p 87-91, June, 1980. 2 Fig, 3 Tab.

Descriptors: *Ultimate disposal, *Sludge disposal, *Composting, Fertilizers, Planning, Waste disposal, Municipal wastes, Incineration, Agriculture, Cost analysis, Feasibility studies, West Hickman Creek Waste Water Treatment Plant, Kentucky, Soil amendments.

An interim sludge management program was proposed after studying four alternatives for the West Hickman Creek Waste Water Treatment Plant, Kentucky. Continued land application of anaerobically digested sludge was recommended. Several capital expenditures suggested were a high flotation tire equipped applicator, belt filter press, and a bridge to provide truck access. It was recommended that liquid slude be applied as frequently as possible, with back-up storage facilities available for unfavorable weather. Careful attention to application rates and groundwater monitoring were mentioned. A cost-effective, long-range disposal plan includes gravity thickening of combined primary and waste activated sludge, anaerobic digestion with utilization of resulting methane gas, chemical conditioning with polymers, dewatering by continuous belt filter press, and composting for use as a soil conditioner. (Cassar-FRC)
W81-01888

CODISPOSAL OF REFUSE AND SLUDGE,
Cosulich (William F.) Associates, Woodbury, NY.
W. F. Cosulich.
Public Works, Vol 111, No 8, p 66-69, August, 1980. 7 Fig.

Descriptors: *Sludge disposal, *Incineration, Disposal, Coburning, Ultimate disposal, Cost estimates, Waste disposal, Municipal wastes.

Methods of coburning sewage sludge and municipal refuse are described. This process may be useful where other disposal systems are costly. The most successful method to date involves coburning unprepared refuse and dewatered sludge in a waterwall or refractory incinerator. Experiences at several European cities are detailed. Plans for U.S. installations using this method are being implemented in Harrisburg, Pa., and Glen Cove, N. Y. Another variation, which coburns refuse-derived fuel in a multiple hearth with limited air, has occasional problems with poor temperature control, hearth erosion, refractory failures, and air pollution. A process using refuse-derived fuel and sludge coburned in a fluidized bed incinerator experienced difficulties with economics and reliability. Unprepared refuse and sludge can also be burned in a modular starved air incinerator. Selection of an optimum method depends upon local costs for energy and sludge-refuse disposal. (Cassar-FRC)
W81-01893

5F. Water Treatment and Quality Alteration

TRIHALOMETHANES: IMPACT OF BROMIDE ION CONCENTRATION ON YIELD, SPECIES DISTRIBUTION, RATE OF FORMATION AND INFLUENCE OF OTHER VARIABLES,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W81-01656

ENGINEERING ANALYSIS OF THE COST/BENEFIT RELATIONSHIP FOR RURAL WATER SUPPLY TREATMENT SYSTEMS,
Missouri Univ.-Columbia. Dept. of Engineering.
G. D. Reed, T. Brown, and L. Dixson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-173759, Price codes: A05 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, University of Missouri Completion Report, October 17, 1980. 83 p. OWRT-A-118-MO(1), 14-34-0001-0127.

Descriptors: *Water treatment, *Cost-benefit ratio, *Rural areas, *Missouri, Optimization, Economics, Treatment facilities, Water districts, Water supply, Computer models.

Rural water supplies have experienced chronic water quality problems which often have been traced to basic management decisions which were made without cost/benefit information to provide viable alternatives. A program was developed based on recent cost data for a wide range of treatment and quality conditions. The program was written in a format which can be used by individuals who are not technically knowledgeable but responsible for management decisions. The program was written in basic so that the user could disect the solution at critical option points. With this information, the user can either obtain treatment estimates for several potential changes and continue working on those which are advantageous or acquire cost information for future budgeting purposes.
W81-01691

EXPERIENCES IN THE USE OF OZONE,
North West Water Authority (England). Eastern Div.
K. A. Sankey, and P. Whatmough.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 5, p 435-452, 1980. 2 Fig, 2 Tab, 15 Ref.

Descriptors: *Ozone, *Water treatment, *Reviews, Pilot plants, Disinfection, Economics, Water quality, Color, Operations research, Maintenance, Operating costs, Electric power costs, Equipment, Toxicity, Safety, Watchgate Plant(UK), *United Kingdom.

The performance, safety and economics of the Watchgate Treatment Plant, which uses ozone in the treatment of water from the Haweswater Reservoir, United Kingdom, are examined. No major problems of plant performance were encountered when pilot scale operations were converted to full scale ozone treatment processes. Ozone was used in a continuous process rather than intermittently to control color and disinfect water supplies. The equipment performance has been generally good. Electrical equipment, heat exchangers, refrigerators, ozonizers and vent gas absorbers all required minimal maintenance. Safety precautions must be executed when working with ozone due to its toxicity. Electrical energy constitutes the major cost of ozone plant operation, but all of the electrical requirements may be met from local sources. No special labor skills are needed to operate an ozone treatment facility other than those required in the usual large water treatment plant. Many of the corrosion problems associated with ozone may be alleviated with the use of polyvinyl chloride pipework. Carbon adsorption of vent gas has been useful in preventing corrosion of disposal ducts.

No problems with water quality have occurred at the Watchgate plant, which supplies 800 thousand people and many industries with strict water quality requirements. Proper operation of an ozonizer will take place only in a very dry atmosphere; therefore, dewpoint analyzers are essential to the Watchgate ozone treatment housing. Methods for monitoring ozone levels in gaseous or dissolved form are also discussed. (Geiger-FRC)
W81-01693

PROCESS AND APPARATUS FOR THE THOROUGH PURIFICATION OF WATER AND THE HIGHLY PURIFIED WATER OBTAINED THEREBY,
Institut Pasteur, Paris (France). (Assignee).
H. S. Marcovich, and R. D. Perrin.
U.S. Patent No 4,202,736, 7 p, 1 Fig, 2 Tab, 5 Ref; Official Gazette of the United States Patent Office, Vol 994, No 2, p 615-616, May 13, 1980.

Descriptors: *Patents, *Water treatment, *Water purification, *Water quality control, Heat, Evaporation, Condensation, Distillation, Equipment, Super heat, Apyrogenic water.

An object of the invention is to provide a process for obtaining water practically devoid of organic residues by a one-step process. In addition an object is to provide a process and apparatus enabling production of entirely reliable highly purified water which is suitable for the most exacting requirements of modern biology. The water is heated to convert it into steam; the steam is passed from a container into a superheating zone and then condensed in the form of purified water. The superheating zone contains at least in part, a packing of a material inert with respect to steam and impurities possibly present in the latter. The steam is superheated in this zone by means of supplementary heating to a temperature exceeding 300 degree C, and reaching notably from 400 degree to 700 degree C, preferably from 500 degree to 700 degree C. Highly purified apyrogenic water freed from undesired organic substances is produced by this process. (Sinha-OEIS)
W81-01730

QUANTITATIVE STUDIES ON A HUMAN PATHOGEN (CANDIDA ALBICANS) AND TRADITIONAL BACTERIAL INDICATORS OF POLLUTION IN DOMESTIC WASTE WATERS AND RECEIVING WATERS,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 5A.
W81-01762

REPORT ON WATER LOSSES,
E. C. Reed.
Aqua, No 8, p 0178-0191, 1980. 5 Fig, 7 Tab, 5 Append.

Descriptors: *Water loss, *Leakage, *Potable water, Water conveyance, Pipes, Conduits, *Water distribution(Applied), Public utilities.

Data on water losses from distribution systems were summarized from information received from 81 towns in 15 countries. Of total leakage from supply systems, an average of 64% is from water mains, 33% from service pipes and customer premises, and 3% from reservoirs. Cost of water, and not metering was a decisive factor in consumption and in existence of leakage control programs. Methods of leakage control and detection and the percentages of towns using these methods are as follows: response only to complaints or problems, 29%; regular leak sounding, 41%; district flowmeters, 4%; and waste metering, 26%. Most detection methods involve a listening device. The most frequent factors causing leaks were soil movement, pipe corrosion, heavy traffic, high pressure, and excavations. (Cassar-FRC)
W81-01773

POTENTIAL OF TUBE SETTLERS IN REMOVING RAW WATER TURBIDITY PRIOR TO COAGULATION,
Mosul Univ. (Iraq). Environmental Engineering Div.
S. Ahmad, and M. T. Wais.
Aqua, No 8, p 0166-0169, 1980. 6 Fig, 2 Tab, 14 Ref.

Descriptors: *Tube settlers, *Water treatment, *Turbidity, Coagulation, *Tigris River(Iraq), Settling velocity, Sedimentation rates, Suspended solids, Iraq.

A 2.6 cm tube settler removed as much as 85% of turbidity from raw Tigris River water at a flow rate of 4.1 cm per minute in a pilot study designed to test the effectiveness of tube settlers on removal of sand, silt, and clay in water prior to coagulation. Flow velocity was the most significant variable. Turbidity removal decreased with increasing flow velocity, with a sharp decrease in efficiency beyond 30 cm per minute. Tube diameter and its interaction with flow velocity was very significant. Optimum tube inclination was 40 degrees. Turbidity removal increased to 60%, remained constant until 80%, then decreased as the ratio of tube length to diameter increased. (Cassar-FRC)
W81-01775

CONTROLLING TASTE AND ODOUR LEVELS IN WATER,
A. J. Bowers.
Water and Pollution Control, Vol 118, No 12, p 14-16, December, 1980. 1 Tab, 3 Ref.

Descriptors: *Taste, *Odor control, *Potable water, Water purification, Water quality, Water pollution effects, Chlorination, Ozone, Activated carbon, *Water treatment.

Control of undesirable taste and odor problems in drinking water is attacked on two fronts--prevention of initial odor development and treatment to reduce odors present. A water source may be protected by reducing industrial discharge, improving the quality of sewage effluents, locating intakes where water quality is unaffected by weather conditions or contamination, using coagulation and flocculation prior to chlorination in the treatment plants, cleaning treatment plant equipment regularly, and maintaining the distribution system properly. If tastes and odors appear in finished water, possible alternatives to chlorination are chlorine dioxide and ozone. Activated carbon may be used to eliminate a large number of tastes and odors. A case study of a 3-day taste and odor problem in a sourthern Ontario municipality illustrates the cost of these problems: 2 million gallons of waste processed water, $1,000 for chemicals, and $6,000 for manpower. (Cassar-FRC)
W81-01850

WATER QUALITY IMPROVEMENT PROGRAM,
D. W. Fitzpatrick.
Public Works, Vol 111, No 5, p 74-75, May, 1980.

Descriptors: *Water quality control, *Polychlorinated biphenyls, *Trihalomethanes, Potable water, Municipal water, *Poughkeepsie(NY), New York, Corrosion, Lead, Water analysis, Chlorination, Activated carbon, Water purification.

The City of Poughkeepsie, N.Y., is pursuing plans to improve the quality of drinking water for its 65,000 customers. There are three major problems. The low level of polychlorinated biphenyls (PCB's) present in water and sediments of the raw source, the Hudson River, will be removed with a post-filtration carbon adsorption system if test results indicate this process will be beneficial. A $112,800 mid-point chlorine injection system is being installed to reduce the amount of trihalomethane formation. Work is being done on a caustic feed process to increase pH in the distribution system so that lead from older pipes will not dissolve into the water. Analytical equipment and personnel have been added to the facilities. A public relations brochure has been issued to increase the consumers' awareness of problems and solutions. It discusses the problems of PCB's, trihalomethanes, and corrosivity. (Cassar-FRC)
W81-01890

FINDING THE RIGHT RX FOR TASTES AND ODORS,
York Water Co., PA. Purification Dept.
D. R. Barnhart.
Public Works, Vol 111, No 6, p 95-96, 130, June, 1980. 1 Tab.

Descriptors: *Taste, *Odor, *Eutrophication, *Algicides, *Water quality, *Water treatment, Reservoirs, Pennsylvania, Water purification, Water pollution, Farm wastes, Activated carbon, Copper sulfate, Chlorination, Potassium permanganate, Nutrients.

Consumers of the York, Pa., Water Company, formed in 1816, experienced the first taste and odor problem in the memory of the system beginning in December, 1973. Algae were in full bloom in the ice-covered reservoirs. Neither activated carbon adsorption nor reducing raw water chlorination was effective in eliminating complaints. Increasing prechlorination residuals to 1-1.25 mg per liter finally reduced odor and taste to acceptable levels. When lake ice had melted, copper sulfate treatment was undertaken. Subsequent blooms were controlled with potassium permanganate until July 1975, when severe algae problems again developed. Odors experienced at various times were described as fishy, muskmelon, cucumber, grassy, earthy, and moldy. Although copper sulfate treatment improved the water quality in about 72 hours, blooms continued for 3 more years. Anabaena and Aphanizomenon had the greatest resistance to treatment. A sampling program and regular copper sulfate treatment have controlled problems since 1975. Possible causes of the elevated nutrient levels, which reach as high as 15 mg per liter, are rotting vegetation in Lake Redman (completed only 6 years before the initial problem) and heavy input of chicken manure into a tributary upstream during 1973. (Cassar-FRC)
W81-01894

HOW TO CONDUCT A GAC ORGANICS REMOVAL PILOT STUDY,
J. L. Fisher.
Public Works, Vol 111, No 6, p 100-102, June, 1980. 3 Fig.

Descriptors: *Activated carbon, *Adsorption, *Water purification, *Organic compounds, Design criteria, *Pilot plants, Water treatment, Water pollution treatment, Trihalomethanes.

Granular activated carbon systems for removing trace organic materials, such as trihalomethanes, from water supplies should be tested in pilot plant studies before designing a full-scale system. Laboratory-obtained adsorption isotherms are not completely applicable to full-scale rates of adsorption. A satisfactory pilot plant should be constructed of stainless steel, brass, teflon and/or glass to minimize organic contamination. Typically, 4 glass columns are used, 5 feet long and 4 inches in diameter, with pressure gauges and relief valves. Six inches of graded gravel is placed in the bottom of the column, and activated carbon in the remainder. The following parameters are monitored: temperature, pH, flow rate, suspended solids level, contaminant level, turbidity, and total organic carbon level. Although the column break-through curve is the most commonly used statistical tool, other methods may include carbon dosage rate curves, mass transfer zone determination, and adsorption capacity calculations. Design criteria obtainable from a field pilot study include effect of various contact times, optimum carbon bed depth, effect of hydraulic loading, number of vessels needed, type of activated carbon needed, carbon life/changeout frequency, carbon exhaustion rate, and contaminant loading rates. (Cassar-FRC)
W81-01895

5G. Water Quality Control

SALMONELLA SURVIVAL IN FRESHWATER AND EXPERIMENTAL INFECTIONS IN GOLDFISH (CRASSUIS AURATUS),
Purdue Univ., Lafayette, IN. Dept. of Microbiology, Pathology and Public Health.

For primary bibliographic entry see Field 5A.
W81-01655

WATER-RESOURCES APPRAISAL OF THE SOUTH-ARKANSAS LIGNITE AREA,
Geological Survey, Little Rock, AR. Water Resources Div.
J. E. Terry, C. T. Bryant, A. H. Ludwig, and J. E. Reed.
Geological Survey Open-File Report 79-924, May, 1979. 162 p, 36 Fig, 50 Tab, 46 Ref, 1 Plate.

Descriptors: *Water resources, *Evaluation, *Water quality, *Lignite, *Arkansas, Groundwater, Surface waters, Water utilization, Available water, Strip mines, Water pollution sources, Coal mines, Chemical analysis, Data collections, *South Arkansas, *Baseline studies, Forecasting, Environmental effects.

The feasibility of developing lignite resources in south-central Arkansas is an important question at the present time (1978). Part of the concern is related to the possible impacts that mining and processing of lignite will have on water resources. Not only will the disturbance caused by excavating affect the quantity and quality of surface and ground water, but the mining, processing, and conversion processes will require the use and consumption of significant quantities of water. To assess the magnitude of the effects of strip mining upon both surface and ground water, baseline conditions (hydrologic conditions in the area prior to mining) must be well defined. A thorough data file and literature search was made so that baseline conditions in the area could be defined. In addition, data-collection networks have been established for the collection of quantitative and qualitative information on streamflow and water levels in the aquifers. Data collected to date at these sites are included in the report. Collection of data at these sites will continue through at least September 1979. Information presented in this report can be used to estimate the quantities of water available for use and the possible effects of mining and associated dewatering on water resources. (USGS)
W81-01674

UNDERDRAIN FOR FILTER TANKS,
S. Kaufman.
U.S. Patent No 4,200,536, 4 p, 5 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 993, No 5, p 1749, April 29, 1980.

Descriptors: *Patents, *Water treatment, *Water quality control, Filters, Filtration, Sands, *Backwashing, Sand filters.

Sand filters include filter beds of sand requiring frequent backwashing to free the beds from sludge or other material collected from the water. The backwashing operation is normally carried out by the introduction of clear water below the filter bed under sufficient pressure to thoroughly churn-up the sand and wash out the sludge. It has been found that underdrains currently used in sand filters fail to uniformly distribute the backwashed water. It is therefore an object of this invention to provide an underdrain for sand filters which effects a uniform distribution of backwash water through the filter bed. The underdrain assembly includes a central hub defining a chamber having sleeves radially extending and elongated hollow tubular elements extending outwardly of the sleeves. These elements have capped terminal ends, are of equal length, are spirally shaped and are equally spaced apart with their perforations being of equal size. Thus, the backwash water fed through the underdrain assembly is distributed uniformly through the filter bed. (Sinha-OEIS)
W81-01718

USE OF NONSTOICHIOMETRIC CARBON-SULFUR COMPOUNDS TO REMOVE COMPONENTS FROM LIQUIDS,
Exxon Research and Engineering Co., Florham Park, NJ. (Assignee).
D. W. Savage, C. H. Chang, and J. M. Longo.
U.S. Patent No 4,201,665, 19 p, 10 Fig, 8 Tab, 10 Ref; Official Gazette of the United States Patent Office, Vol 994, No 1, p 249, May 6, 1980.

Descriptors: *Patents, *Water treatment, *Separation techniques, Carbon, Sulfur, Adsorption, Waste water treatment, *Regeneration.

The invention relates to a process for removing organic and/or inorganic materials from aqueous and/or non-aqueous liquids by contact with nonstoichiometric carbon-sulfur compounds under adsorption conditions. Such compounds may be prepared by a variety of techniques including reacting a carbonaceous material at elevated temperatures with a sulfur-containing gas. Suitable carbonaceous materials from which C sub x S may be prepared include coal chars, conventional activated carbons, petroleum fluid coke, sucrose char, various polymeric chars and the like. The value of x is not critical and may range broadly. Spent C sub x S adsorbent may be regenerated thermally, by solvent extraction or by vapor stripping. (Sinha-OEIS)
W81-01724

DEPOSIT CONTROL THROUGH THE USE OF OLIGOMERIC PHOSPHONIC ACID DERIVATIVES,
Betz Lab., Inc., Trevose, PA. (Assignee).
L. W. Becker, P. S. Davis, and I. D. Morrison.
U.S. Patent No 4,201,669, 10 p, 10 Tab, 4 Ref; Official Gazette of the United States Patent Office, Vol 994, No 1, p 250, May 6, 1980.

Descriptors: *Patents, *Water treatment, *Cooling water, Industrial water, Boiler feed water, Water quality control, Scaling, Demineralization, Recirculated water.

The invention is directed to aqueous systems such as, but not limited to, cooling water systems, pulp and paper mill systems, boiler water systems and gas scrubber systems where the formation and/or deposition of materials contained in them can and would most likely cause problems because of decreased flow rates, lost energy efficiency, poor quality products or pollution considerations. The problems associated with scale formation and deposition, the deposition of iron compounds, etc. in industrial water systems are well known. This disclosure is directed to oligomeric phosphonic acid derivatives which possess excellent chlorine resistance and acceptable calcium tolerance and which, at substoichiometric amounts, inhibit the formation of scale in aqueous mediums. Additionally, the oligomers have been found to be quite active as dispersants for particulate matter contained in an aqueous medium. (Sinha-OEIS)
W81-01727

PROCESS AND APPARATUS FOR THE THOROUGH PURIFICATION OF WATER AND THE HIGHLY PURIFIED WATER OBTAINED THEREBY,
Institut Pasteur, Paris (France). (Assignee).
For primary bibliographic entry see Field 5F.
W81-01730

BACKWASH WATER RECYCLING SYSTEM,
PepsiCo., Inc., Purchase, NY. (Assignee).
For primary bibliographic entry see Field 3E.
W81-01736

DETENTION BASIN SETTLEABILITY OF URBAN RUNOFF POLLUTION PHASE II,
Rutgers-The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr., and J. V. Hunter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170474, Price codes: A03 in paper copy, A01 in microfiche. Final Technical Completion Report, Dec., 1980. 29 p, 9 Fig, 16 Ref. OWRT-A-058-NJ(2), 14-34-0001-0132.

Descriptors: *Detention reservoirs, *Water pollution control, *Storm runoff, *Sediment control, Water pollution, Pollution, Heavy metals, Oil pollution, Organic wastes, Coliforms, Sediment, Storm water, Settling basins, *Storm water management, *Dual purpose detention basins, *Setteability of pollutants.

Because of the growing interest in stormwater management, and particularly of the possibility of using detention basins for removing particulate pollution, it is important to determine the effectiveness of such basins for removal of various polluting substances. In a first phase of the present study samples of urban runoff were allowed to settle in a large tube, and the quantity of each pollutant settling in a given time period determined. There was more variability in rate of settlement of specific pollutants than for total suspended solids. Lead and hydrocarbons settled out 60-65% in 32 hours, only slightly slower than total suspended solids. BOD and copper were removed at somewhat lower rates, and zinc even lower. These results confirm the effectiveness of retention of stormwater in removing particulate pollutants. In the second phase of the study two detention basins were modified by constructing outlets so as to provide prolonged retention of stormwater; and observed trap efficiency of various pollutants was compared to computed trap efficiency and to the results of laboratory settleability of the same pollutants. Results indicate that laboratory settleability may be a useful tool in estimating probable effectiveness of dual purpose detention basins for the retention. (See also W80-04807)(Whipple-Rutgers)
W81-01756

CHIRONOMID FARMING-A MEANS OF RECYCLING FARM MANURE AND POTENTIALLY REDUCING WATER POLLUTION IN HONG KONG,
Chinese Univ. of Hong Kong, Shatin. Dept. of Biology.
P-C. Shaw, and K-K. Mark.
Aquaculture, Vol 21, No 2, p 155-163, October, 1980. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Diptera, *Water pollution control, *Pollution abatement, Farm wastes, Fish food organisms, Larvae, Insects, Recycling, Waste treatment, On-site investigations, Economic efficiency, Fertilizers, Cultures, Agriculture, Hong Kong.

In Hong Kong, chironomid larvae grown on chicken manure are being used for fish food in fish cultures and as live food for aquarium fish. It has been estimated that an area of 13.5 ha is used continuously for chironomid farming, producing over 85% of the country's chironomid larvae and using up 0.6% of the annual load of chicken manure. The manure would otherwise have been discharged into farm streams, causing serious pollution problems in local rivers. Field studies on a chironomid farm were conducted from February to June, 1979. Results showed that an average of three crops of larvae per field, totaling 139.0 kg, would yield approximately $458.6 in gross income based on the normal US wholesale price of $3.30/kg of larvae. Successful growth of chironomid larvae on chicken manure-enriched water in pans in plastic greenhouses has also been reported. The chironomid larvae are easily managed and pose no danger to human health. More chicken manure is consumed by farming chironomids than by fertilizing for agricultural purposes. Other farm wastes such as pig and sheep manure have also been tested for the culturing of chironomid larvae. Development of chironomid farms is seen as an economical method to help alleviate the pollution of streams by farm wastes. (Geiger-FRC)
W81-01776

LIMING ACID LAKES IN SWEDEN,
National Board of Fisheries, Goeteborg (Sweden).
B. Bengtsson, W. Dickson, and P. Nyberg.
Ambio, Vol 9, No 1, p 34-36, 1980. 7 Fig, 4 Ref.

Descriptors: *Lime, *Lakes, *Acidic water, Water pollution, Neutralization, Air pollution, *Sweden, Rivers, Aquatic microorganisms, Fish, Salmon, Perch, Aquatic life, Zooplankton, Phytoplankton.

In 1976 the Swedish government initiated liming lakes and rivers to improve the quality of water polluted by acid rains. During 1977-1979, 700 lakes

and rivers were treated directly with a total of 120,000 tons of lime. A single application may be effective for 5 to 10 years. Ecological studies showed that liming acid waters greatly increased the populations of zooplankton, phytoplankton, and fish. However, pH often decreases during periods of high water flow, such as snow melt, due to stratification. The present budget for the liming project is $2.5 million, about one tenth of the actual need. Proposed funds for 1980 and 1981 are $5 million and $7.5 million, respectively. (Cassar-FRC)
W81-01814

DESIGNING FOR FORCE MAIN ODOR CONTROL,
Cahn, Inc., Wallingford, CT. Process Systems.
M. A. Vivona.
Public Works, Vol 111, No 7, p 74-76, July, 1980. 2 Fig, 3 Tab.

Descriptors: *Odor control, *Water quality control, *Aeration, Sulfides, Sulfates, Biochemical oxygen demand, Water properties, Design standards.

A typical problem encountered in the attempt to control odor by force main air injection is explored and a solution is offered. Air injection must be planned in dependence on the reaction rate, assuming oxygen uptake from the air supplied. Factors involved in calculating the injection parameters include temperature, enzyme lag, carbonaceous and nitrogenous biochemical oxygen demand, and sulfate and sulfide equilibria. The design of the system must act in general to inhibit odor formation. This is accomplished by shifting the metabolism of microorganisms present from anaerobic to aerobic. Upstream treatment in collection systems involved an oxidant for odorous compounds, and/or a source of oxygen to defer anaerobic metabolism. The amount and rate of aeration required in a force main for odor control is determined by the oxygen reaction rate and the detention period at minimum flow. An example is given which demonstrates the means of determination of compressor capacity, power and operating energy requirements. The capacity of the compressor required is related directly to the capacity of the pump. The typical air injection pressure is usually between 5 and 10 psi higher than the force main pressure at the point of injection. Most standard compressors are rated at 100 psig. At lower pressures more air can be delivered at reduced power. At high compressor capacities diurnally programmed air feed should be considered. (Baker-FRC)
W81-01891

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

HYDROLOGY AND MODEL STUDY OF THE PROPOSED PROSPERITY RESERVOIR, CENTER CREEK BASIN, SOUTHWESTERN MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-01660

HYDROLOGIC ANALYSIS OF THE PROPOSED BADGER-BEAVER CREEKS ARTIFICIAL RECHARGE PROJECT, MORGAN COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
A. W. Burns.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-227887, Price codes: A05 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations 80-46, July, 1980. 90 p, 44 Fig, 19 Tab, 30 Ref.

Descriptors: *Artificial recharge, *Project planning, *Model studies, *Hydrologic budget, *Colorado, Canals, Diversion, Water delivery, Ponds, Waterfowl, Flow augmentation, Surface-groundwater relationships, Aquifers, Water table, Water levels, Pumping, Available water, Hydrogeology, Projections, *Morgan County(CO), *South Platte River(CO), Badger Creek(CO), Beaver Creek(CO).

A hydrologic analysis of the proposed Badger-Beaver Creeks artificial-recharge project in Morgan County, Colo., was made with the aid of three digital computer models: A canal-distribution model, a ground-water flow model, and a stream-aquifer model. Statistical summaries of probable diversions from the South Platte River based on a 27-year period of historical flows indicate that an average-annual diversion of 96,000 acre-feet and a median-annual diversion of 43,000 acre-feet would be available. Diversions would sustain water in ponds for waterfowl habitat for an average of about five months per year, with a minimum pond surface area of about 300 acres with the median diversions and a maximum pond surface area of about 1,250 acres at least one-half of the years with the historic diversions. If the annual diversion were 43,000 acre-feet, recharge to the two alluvial aquifers would raise water levels sufficiently to create flowing streams in the channels of Beaver and Badger Creeks while allowing an increase in current ground-water pumping. The only area of significant waterlogging would be along the proposed delivery canal on the west edge of Badger Creek valley. If the total water available were diverted, the aquifer system could not transmit the water fast enough to the irrigation areas to avoid considerable waterlogging in the recharge areas. The impact of the proposed project on the South Platte River basin would be minimal once the ground-water system attained steady-state conditions, but that may take decades with a uniform diversion of the 43,000 acre-feet annually. (USGS)
W81-01670

WATER-RESOURCES APPRAISAL OF THE SOUTH-ARKANSAS LIGNITE AREA,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 5G.
W81-01674

ANALYSIS OF WATER RESOURCES PLANNING AND DECISION-MAKING PROCESSES AND OUTCOMES,
Policy Sciences Associates, Boulder, CO.
W. B. Lord, P. A. Bolton, J. A. Chase, and R. L. Cook.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170482, Price codes: A05 in paper copy, A01 in microfiche.
Research Report 81-1, prepared for Office of Water Research and Technology, January, 1981. 71 p, 4 Fig, 12 Tab, 10 Ref, 4 Append. OWRT-C-80081-P(No 8404)(1), 14-34-0001-8404.

Descriptors: Planning, Decision making, Institutions, *Programs, *Governmental interrelations, *Project planning, Water policy, *Feasibility studies, Priorities, Planning objectives, Planning purposes, Goals.

Federal water resources planning can be conducted in different ways and can produce different outcomes. The purpose of this research project was to investigate how different ways of doing planning might lead to different outcomes, and to reveal the preferences for those outcomes which characterize persons who have participated in water resources planning within different federal programs and in different roles. Information on the outcome preferences of recent participants in planning within five different federal programs was collected through the use of nominal group and judgement analysis techniques. Information concerning planning process variants and their potential association with outcome attainment was collected through literature reviews and the use of panels of experts. The sampled participants placed a lower priority upon attaining national goals than other possible planning outcomes. Solving local problems is the outcome with highest priority, while resolving conflicts and improving public understanding are assigned intermediate priorities. There are substantial differences in how planning should be conducted, depending upon the outcomes desired. Clear and specific federal mandates, the use of instrumental rationality or consensus building as planning modes, and the selection of participants in the planning process are key variables. Hypothetical process-outcome models are provided.
W81-01755

WATER RESOURCES PLANNING USING COMPUTER GRAPHICS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
P. N. French, L. E. Johnson, D. P. Loucks, and D. P. Greenberg.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 21-42, March, 1980. 29 Fig, 4 Ref.

Descriptors: *Computer models, *Planning, Computer programs, Data processing, *Water resources development, Water management, Water quality control, Costs, Flood data, Flood forecasting, Graphical analysis.

Computer simulation and optimization models that are used to assist in multipurpose, multiobjective water resource planning often suffer from the lack of an efficient data input system and the lack of an easy yet comprehensive means of interpreting and communicating the results of model studies to others. These deficiencies may be minimized with the help of computer graphic input and display methods. Interactive computer graphics was applied to four planning problems, which included the prediction and management of water quality, multi-reservoir simulation for water supply, multiobjective analyses for reservoir sizing, cost and yields, and flood management. Tablet digitizing routines were frequently used to input spatial and other data, while the graphical output was accomplished by vector display methods. Visual feedback was obtained at all stages of the procedures. As the cost of computer memory declines, the use of the graphics input and display devices is expected to increase. (Geiger-FRC)
W81-01841

6B. Evaluation Process

POTENTIAL FOR USING THE UPPER COACHELLA VALLEY GROUND-WATER BASIN, CALIFORNIA, FOR STORAGE OF ARTIFICIALLY RECHARGED WATER,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-01663

DISSOLVED OXYGEN MEASUREMENTS IN OHIO STREAMS FOLLOWING URBAN RUNOFF,
Ohio State Univ., Columbus. Water Resources Center.
For primary bibliographic entry see Field 5B.
W81-01684

AN ECONOMIC ANALYSIS OF EFFLUENT STANDARDS FOR BOD, AMMONIA, TOTAL SUSPENDED SOLIDS, AND DISINFECTION: CASE STUDY OF A MODERN TREATMENT PLANT,
Donald L. Hey and Associates, Chicago, IL.
For primary bibliographic entry see Field 5D.
W81-01701

WATER USE, PROJECTED WATER REQUIREMENTS, AND RELATED DATA AND INFORMATION FOR THE STANDARD METROPOLITAN STATISTICAL AREAS IN TEXAS.
Texas Dept. of Water Resources, Austin Planning and Development Div.
Draft Report LP-141, August, 1980. 216 p, 30 Fig, 3 Tab, 2 Append, 1 Map.

Descriptors: *Texas, *Water resources planning, *Projections, *Water users, Comprehensive planning, Administration, City planning, Forecasting, Decision making, Management, Water allocation, Water management, Water resources development, Federal Water Pollution Control Act.

A presentation of current and projected water resources data and related information for each of the twenty-five Standard Metropolitan Statistical Areas (SMSAs) in Texas. Texas has fifteen major river basins and eight coastal basins which have approximately 3,700 designated streams and tributaries and more than 80,000 miles of streambed. Texans currently use about 17.5 million acre-feet of water per year, of which 12.2 million come from groundwater supplies. Most of the remaining surface water reserves are committed for foreseeable growth, and demands on the groundwater supplies are lowering water tables to the extent that major water supply problems are expected to occur in the foreseeable future. The SMSAs are depicted in relation to the river and coastal basins and are also cross-referenced on a map of the state to show the distribution of normal annual precipitation. A statewide perspective on water resources, their development and use, water quality planning and flood plain management is given. Each SMSA is analyzed in terms of present and future water use, planning, and management. The water supply outlook, problems, and possible solutions are discussed for the State as a whole and for each SMSA. (Garrison-Omniplan)
W81-01742

EMPIRICAL APPLICATION OF A MODEL FOR ESTIMATING THE RECREATION VALUE OF WATER IN RESERVOIRS COMPARED TO INSTREAM FLOW,
Colorado State Univ., Fort Collins. Dept. of Economics.
R. G. Walsh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-170532, Price codes: A04 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Completion Report, December, 1980. 50 p, 7 Fig, 4 Tab, 65 Ref, 1 Append. OWRT-A-041-COLO(1), 14-34-0001-9006, 14-34-0001-0106.

Descriptors: *Water values, *Streamflow, *Reservoirs, *Recreation demand, Rivers, Evaluation, Economic feasibility, Cost analysis, Model studies, Value, Flow, Natural flow, Riverflow, Flow augmentation, Streamflow forecasting, River forecasting, Streams, Reservoir yield, Water supply, Reservoir sites, Reservoir operation, Reservoir yield, Recreation facilities, Recreation, Economics, Estimation, Colorado, *Rocky Mountain Region, Cold-water fishing.

Analysis was made of water value used for cold-water fishing at high mountain reservoirs/rivers located in the Colorado Rocky Mountains, which will contribute to an economic assessment of the tradeoff between providing recreational opportunities at high mountain reservoirs (HMR) and maintaining instream flow for river recreation use. Representative numbers (130) of fishermen were interviewed during the summer of 1978 at six sites (3 HMRs and 3 rivers), 6,000-10,000 feet in elevation. Willingness to pay was found to be contingent on changes in congestion and water level. Economic benefit functions were adjusted for crowinding, water level, access, participants' characteristics, and management costs. Providing access to 30% or 15% more HMRs would increase existing reservoir fishing benefits by an average of $3.27 or $1.25 per user-day, respectively, but once optimum capacity is reached, future expansion of fishing opportunities would be valued as average benefits of $10.26 and $11.78 per user-day on reservoirs and rivers respectively. Maximum benefits occur with an instream flow 35% of maximum flow. (Zielinski-IPA)
W81-01752

AGING URBAN WATER SYSTEMS: A COMPUTERIZED CASE STUDY,
Betz, Converse, Murdoch Inc., Plymouth Meeting, PA.
For primary bibliographic entry see Field 8A.
W81-01877

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

TREATED WATER DEMAND AND THE ECONOMICS OF REGIONALIZATION; VOLUME 2, ECONOMICS OF REGIONALIZATION: THE ELECTRIC POWER EXAMPLE,
Alabama Univ., University.
D. L. Hooks.
Environmental Protection Agency Report EPA-600/2-80-163, August, 1980. 60 p, 5 Fig, 5 Tab, 66 Ref, 1 Append. R805617.

Descriptors: *Utilities, *Economics, *Water supply, Electric power industry, *Water demand, Water distribution(Applied), Diseconomies of scale, Economic efficiency, Coordination, Planning.

One of the consequences of the Safe Drinking Water Act of 1974 has been an emphasis on the possible benefits of consolidating water suppliers into regional systems to offset some of the increased costs through scale economics and other gains in economic efficiency. Consolidation in the electric power supply industry is investigated as an example of a possible method for offsetting these new costs of water treatment. The structure of the power industry is examined along with the history, potential advantages, and costs and benefits of coordination. Alternatives to the present power system are also considered. The electric power industry has attained a high degree of interconnection and significant levels of coordination or consolidation on a regional basis, yet the extent of coordination and consolidation has not been as great as had earlier been predicted and advocated on grounds of economic efficiency. Evidence available indicates that few economic benefits have actually been realized from coordination. Some power systems or functions (distribution, for example) are larger than the optimum size. Only about 42% of the community water systems are privately owned, and they supply only 12% of the treated water in the United States. The greatest potential gains from consolidation may be among private systems and between publicly owned and private utilities. Alternative ways to capture the potential economies of regionalization may also be viable. These include pooling and coordination to the degree that the cost savings warrant, up to and including large systems under common ownership. (Moore-SRC)
W81-01680

DEVELOPMENT AND APPLICATION OF A WATER SUPPLY COST ANALYSIS SYSTEM; VOLUME I,
ACT Systems, Inc., Winter Park, FL.
J. I. Gillean, W. L. Britton, Jr., J. H. Brim, and R. M. Clark.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-152183, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-012a, July, 1980. 80 p, 24 Fig, 2 Tab, 7 Ref, 2 Append. 68-03-2506.

Descriptors: *Cost analysis, *Utilities, *Water rates, *Data collections, Kentucky, Water costs, Water supply, Management, Water treatment, Water delivery, Operation and maintenance.

Although most utilities maintain an accounting system, the data provided by these systems are maintained in different formats and are therefore incompatible among utilities. Few systems provide continuous and adequate cost information directly. The Environmental Protection Agency initiated a research program to develop standardized techniques for analyzing costs witin a utility accounting framework. The system has been implemented successfully in Kenton County Water District No. 1 in Kentucky. Overall, the performance of the system has been impressive. In addition to providing useful management reports, the cost analysis system has assisted in improving the existing Kenton County Water District financial reporting system. The utility director has used the data to make key decisions regarding operations and for establishing billing rates to selected users, as well as for a general rate re-evaluation study. The system, using a matrix concept, can match operational and financial data at the top level functions of acquisition, treatment, delivery, and support services, and for two lower levels of detail. This system allows a water utility manager to evaluate the cost of the utility down to the smallest componet of the system. The costs are logically structured so one can move from one level to another with compatible data. The system can be used to estimate the cost of water as it flows through the actual utility system and is delivered to the various consumers. The reports generated by the system can be used to compare budgeted versus actual expenditures as well as a cost comparison between specific operations for different time periods. (Moore-SFR)
W81-01682

THE CONSTANT PERCENT RULE IN INTRA-SECTORAL WATER ALLOCATION,
Florida Univ., Gainesville. Dept. of Food and Resource Economics.
G. D. Lynne, and C. F. Kiker.
Economic Report 97, May, 1980. 16 p, 2 Fig, 1 Tab, 15 Ref.

Descriptors: *Florida, *Water allocation, *Cost allocation, Prices, *Water rates, Supply, Pricing, *Water distribution(Applied), Water allocation(Policy), Water demand, Economics, Water supply, Competing uses, Water consumption, Water policy, Commerical use.

Water management districts in Florida are charged with allocating water among competing users, including the commercial sector. Two water allocation rules are the 'constant percent rule' (CPR) and the 'economic efficiency rule' (EER). The study uses a 'best guess' total water demand curve relationship in addition to empirical estimates from an earlier study to show that CPR, which provides a uniform percentage reduction, does not provide equal benefit reductions. Under the EER rule, water is allocated among competing users during water-short periods to maximize economic efficiency. Total benefit losses from a required overall reduced use of 15% may be greater with the CPR, while implementing the EER through raising prices resulted in substantial reduction of benefit losses to three of the four groups considered---grocery stores, eating and drinking establishments, and hotels-motels, but not department stores. The hotel-motel group gained the most from the use of the EER in both a relative and an absolute sense. (Garrison-Omniplan)
W81-01739

ALBERTA ENVIRONMENT MINISTER FORESEES MANY CHALLENGES FOR PROVINCE IN THE '80'S.
For primary bibliographic entry see Field 6E.
W81-01851

DEVELOPING A COST-EFFECTIVE SLUDGE MANAGEMENT APPROACH,
Proctor-Davis-Ray, Inc., Lexington, KY.
For primary bibliographic entry see Field 5E.
W81-01888

6D. Water Demand

LAKE MICHIGAN WATER ALLOCATION IN ILLINOIS,
Illinois State Dept. of Transportation, Springfield. Div. of Water Resources.
F. L. Kudrna, D. R. Vonnahme, and K. L. Brewster.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 43-54, March, 1980. 1 Fig, 1 Tab, 5 Ref.

Descriptors: *Water allocation(Policy), *Water management(Applied), *Lake Michigan, Potential water supply, Water resources, Water conservation, Regulation, *Illinois, Equitable apportionment, Planning.

The process used by the Illinois water authorities to allocate Lake Michigan water to communities in northeastern Illinois to ensure that all communities will have adequate water for projected growth and development is described. Water allotment was developed from data collected in 1974 covering 6 counties and a population of 7,000,000 people. The principal factors considered were historical growth, new growth areas available through annexation, and land available for development within existing municipal boundaries. Per capita water consumption was also considered. Water demand for five steel mills was considered separately from municipal demand. Water resources available to the area were assessed, and the water allocation order was issued. A water conservation program is briefly described which includes placing brochures on water conservation in utility bills and providing schools with water conservation information. Systems management is also currently used to identify and properly use water resources. Continuous monitoring of water demand and use indicates that the allocation plan will meet Illinois' needs until 2010. (Small-FRC)
W81-01839

SLUDGE DEWATERING PLANT USES PROGRAMMABLE CONTROLLERS.
Public Works, Vol 111, No 2, p 82, February, 1980.

Descriptors: *Sludge, *Dewatering, *Centrifugation, Waste water treatment, Equipment, Sewage sludge, *Sludge treatment, Separation techniques, Control systems, *Los Angeles County, California.

The Los Angeles County's Carson sludge dewatering plant employs four huge centrifuges to meet new water quality standards. Each unit is fed wet sludge until a predetermined volume of dry solids is collected. A single programmable controller operates all four centrifuges, which saves on overall costs for the operation. When full the centrifuges are emptied with the inverters at low speed. When the centrifuges have decelerated to 50 rpm, a plow is introduced into the bowl of each to cut out the sludge cake which falls onto a conveyor a floor below. The cycle takes only about 20 minutes; however, more control problems are encountered than would occur in a continuous system. This is attributed to the static state of the system and the need for the controller to continuously monitor process conditions and initiate corrections. The controls are economical and flexible. They may be quickly programmed, and are not affected by dirt and wear, since they contain no moving parts. Numerous pilot studies were conducted with the control programs to make modifications and improvements before the equipment was installed. The efficiency and reliability of the process has enabled the programming to be routinely handled by plant engineers. (Geiger-FRC)
W81-01896

6E. Water Law and Institutions

AN INDUSTRY POINT OF VIEW,
British Columbia Packers, Ltd., Vancouver.
R. I. Nelson.
In: Pollution and the Fisheries: Proceedings, 27th Annual Meeting of the Fisheries Council of Canada, Environmental Protection Service, Report No EPS 3-WP-73-4, August 1973, p 28-35.

Descriptors: *Cost sharing, *Water pollution control, *Jurisdiction, *Industrial wastes, *Canada, Construction costs, Costs, Expenses, Legal aspects, Federal jurisdiction, Political aspects, Aquatic life, Water quality, Water quality control, Water quality standards, Water policy, Control, Pollution abatement, Industrial production, Cost analysis, Operating costs, Fisheries.

Adequate water quality is critical to fish survival. Certain pollutants, at levels below those affecting survival, can be concentrated in fish, making them unsuitable for eating. Thus, the fishing industry, although engaged in processing operations that produce wastes contributing to pollution, views pollution as a serious problem. Societal, political, and economic concerns exist. The recent 'scare' of mercury in certain fish species resulted in social concern for the quality of fish in general. Public presentation of balanced and realistic views provided by the government is needed. For pollution control, financial assistance should be provided. The Canadian Federal Government is spending more than one billion dollars for regional economic development programs, but the Department of the Environment has no funds for assistance to industry in controlling pollution problems. Without government assistance, the cost of pollution control systems by industry will cause sacrifice of modernization/expansion plans and failure of some businesses. Also, conflicts of jurisdiction occur for water uses: international, interprovincial or Federal-provincial. Examples have been noted. The International Joint Commission should assist resolution of Canadian-United States conflicts. (Zielinski-IPA)
W81-01707

STATE/EPA AGREEMENT, FY 81.
Washington State Dept. of Social and Health Services, Olympia.
September, 1980. 607 p, 10 Fig, 26 Tab, 18 Append.

Descriptors: *Washington, *Environmental engineering, Air environment, *Solid wastes, *Water quality standards, Waste disposal, Monitoring, Administration, Planning, Comprehensive planning, Natural resources.

Six environmental program issues plus an Executive Summary comprise the FY 81 agreement between the State of Washington and the U.S. Environmental Protection Agency. This document, which identifies commitments by each party to specific program priorities in FY 81, includes sections on Program Coordination, Water Quality Management, Solid and Hazardous Waste Management, the Washington State Drinking Water Program, Air Quality Management, and a Responsiveness Summary. Priority environmental problems listed include: Mt. St. Helens eruptions, which caused catastrophic local water system disruptions and continued air and water quality problems from ash fall; hazardous waste disposal, for which an acceptable site must be found and developed; energy facility sites, which must be identified and analyzed for environmental and socioeconomic impacts; municipal waste water, for which treatment plants must be upgraded; water quality problems in rivers, which include high bacterial counts, elevated temperatures, and high turbidity; air quality, in relation to areas in the state that have not achieved the national ambient air quality standards; and small public water systems, which have trouble maintaining water quality facilities. Program solutions are described for each of these priority problems, and methods for monitoring state and EPA commitments are defined. (Mantius-Omniplan)
W81-01743

ANALYSIS OF WATER RESOURCES PLANNING AND DECISION-MAKING PROCESSES AND OUTCOMES,
Policy Sciences Associates, Boulder, CO.
For primary bibliographic entry see Field 6A.
W81-01755

WATER POLLUTION CONTROL IN JAPAN,
Water Resources Development Public Corp., Tokyo (Japan).
T. Hayashi.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 850-861, May, 1980. 1 Fig, 3 Tab.

Descriptors: *Legislation, *Standards, Water conservation, Administration, Water quality, *Water pollution control, Government, Toxins, *Japan.

The history of water quality legislation and administration in Japan, including current conservation and effluent control measures, is reviewed. The Water Quality Conservation Law was enacted in 1958 as an attempt to systematize water pollution control and establish effluent standards. The Factory Effluents Control Law of 1959 set penalties for industrial contamination. Increased environmental problems resulted in the passing of the Basic Law for Environmental Pollution Control in 1967, which established basic guidelines for determing the scope of environmental pollution, the responsibilities of those concerned, and the methods and measures for control. The Water Pollution Control Law of 1970 and the Seto Inland Sea Conservation Law of 1973 were even more specific. Water control standards set by administrators of water pollution programs are presented in a table. Water quality in Japan has improved in recent years, reflecting the vigorous enforcement of stronger control measures. The percentage of water quality samples that met the environmental water quality standards for nine toxic substances increased to 99.6% in 1977. Recent amendments to laws are reviewed. (Small-FRC)
W81-01794

CONFLICT BETWEEN ENERGY CONSERVATION AND WATER POLLUTION CONTROL STANDARDS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
J. C. Lamb, III.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 656-660, April, 1980.

Descriptors: *Energy, *Conservation, *Regulation, Legislation, *Water pollution control, Pollution abatement, Environmental effects, Water quality standards.

Environmentalists have insisted on careful evaluation of the environmental impacts of energy resource development, but now must consider the energy impact of environmental actions. Present water pollution regulatory programs require the installation of some waste water treatment plants that serve no justifiable function. All municipalities are required to install secondary treatment facilities, whether those communities produce oxygen consuming wastes or not. Furthermore, plants are required to operate continuously with no regard to waste flow. Finally, if the plant fails to meet standards, the owner is fined and required to make costly changes even if no environmental damage has been done. Blanket standards are wasteful. The approach should be modified to permit logical, scientifically correct, and environmentally necessary flexibility in administering pollution control standards. Goals can be accomplished without systematic waste. (Small-FRC)
W81-01821

POLICY ISSUES CONCERNING WATER QUALITY/QUANTITY,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 71-79, March, 1980. 5 Ref.

Descriptors: *Water policy, *Cost-benefit analysis, Project planning, Governmental interrelation, Water quality standards, Water law, U.S. Water Resources Council, *Water management.

A coordinated approach of total water management is presented as a method which can achieve national water quality goals more efficiently than the Principles and Standards of the Water Resources Council. Lack of coordination between EPA, HUD, the Soil Conservation Service, and the Corps of Engineers, including differences in feasibility criteria and cost-sharing arrangements, results in a lack of effective water quality management. Policy alternatives to integrate water quantity and water quality planning are discussed. The most workable alternative is to decide on desired water quality goals and then apply cost-effectiveness criteria to all pollution sources, point and

nonpoint. Using this approach, it would not be necessary to determine economic benefits of water quality improvements, but only to determine which of the available approaches would reach the desired environmental goal at the lowest cost. (Small-FRC)
W81-01835

ALBERTA ENVIRONMENT MINISTER FORESEES MANY CHALLENGES FOR PROVINCE IN THE '80'S.
Water and Pollution Control, Vol 118, No 12, p 20-21, December, 1980.

Descriptors: *Alberta, *Water supply, *Sewage treatment, *Grants, *Financing, Waste water treatment, Calgary, Edmonton, Public utilities, Phosphorus compounds, Municipal water, Government finance, Water policy, Costs.

John W. Cookson, Alberta Minister of the Environment, described the functions of the Alberta Municipal Water Supply and Sewage Treatment Grant Program during the keynote address at the Western Canada Water and Sewage Annual Conference. Municipalities of all sizes are eligible for aid to either upgrade or replace present facilities or install new plants. The Edmonton Regional Utilities Study examined solutions to water supply and sewage disposal problems within the 13,800 square kilometer area surrounding the city, which is the site of current high population growth. Calgary's modern waste water treatment plant was mentioned as an example of pollution problems. A phosphorus removal grant program (total $18.1 million over 6 years) was established to help all communities install phosphorus removal facilities. The city will pay the first $20 per capita, and then receive 90% of capital costs from the Province. (Cassar-FRC)
W81-01851

7. RESOURCES DATA

7B. Data Acquisition

WATER LEVEL RECORDER,
Systron-Donner Corp., Concord, CA. (Assignee).
J. D. Gearheart, and F. W. Jenkinson.
U.S. Patent No 4,200,876, 7 p, 7 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 993, No 5, p 1849, April 29, 1980.

Descriptors: *Patents, *Water level recorders, Instrumentation, Water levels, Water level fluctuations, Data transmission, Monitoring.

A water level recorder for use with pressure-sensitive chart paper has a framework with a lead screw rotatably mounted in the framework. A pulley is secured to the lead screw. The pulley is driven by a tape which is positioned by a float that is adapted to rest upon the surface of the water. A lead screw nut is mounted on the lead screw for movement longitudinally of the lead screw as it is rotated. A marking member is carried by the lead screw nut. A drum is secured to the lead screw for rotation with the lead screw. A helix for marking the chart paper is formed on the drum. Chart paper drive means are provided for advancing the chart paper over the helix and the marking member. Platen assemblies movable into and out of engagement with the chart paper are adapted to engage the chart paper to retain it so that two traces are formed on the chart paper as it is advanced, one by the marking member and one by the helix to give coarse and vernier indications respectively of the water level being measured. (Sinha-OEIS)
W81-01719

SATELLITES AS AID TO WATER RESOURCE MANAGERS,
National Environmental Satellite Service, Washington, DC.
D. F. McGinnis, Jr., R. A. Scofield, S. R. Schneider, and C. P. Berg.
Journal of the Water Resources Planning and Mangement Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WR1, p 1-19, March, 1980. 14 Fig, 1 Tab, 14 Ref.

Descriptors: *Satellites(Artificial), *Data collections, *Water management, Water resources development, Monitoring, Snow managment, Ice jams, Ice breakup, Flood forecasting, Precipitation intensity, Remote sensing.

The application of satellite-gathered environmental data to certain water resource planning problems is considered. Data useful to the water resource management field that can be obtained via satellite pictures include area of snow cover, river ice breakup, flood extent maps, and precipitation estimates from convective systems. The National Oceanic and Atmospheric Administration (NOAA) currently operates the NOAA polar-orbiting system of satellites and the GOES system of geostationary satellites. The systems possess 1 km resolution visible sensors which are sufficient for monitoring various mesoscale and macroscale water resources. Snow surveillance was done by satellite on 30 river basins in the United States and Canada during the winter of 1977-78. Satellite pictures may also serve as daily monitoring systems to provide early warnings of ice jams along rivers. Convective rainfall is calculated by comparing the changes in two consecutive pictures, both IR and high-resolution visible. Some rainfall images as portrayed by satellite for parts of Missouri are given, along with satellite pictures of Hurricane Anita over Texas in September 1977. (Geiger-FRC)
W81-01840

A SIMPLE AND INEXPENSIVE 4-PI LIGHT COLLECTOR AND TWO DESIGNS FOR A LIGHT METER FOR LIGHT ATTENUATION STUDIES,
Southampton Univ. (England). Dept. of Oceanography.
P. J. leB. Williams, and N. W. Jenkinson.
Freshwater Biology, Vol 10, No 6, p 491-496, December, 1980. 4 Fig, 1 Plate, 8 Ref.

Descriptors: *Instrumentation, *Light penetration, Aquatic productivity, Phytoplankton, On-site tests, Water bodies, Light intensity, *Selenium photocells.

A simple, inexpensive device for measuring light attenuation in the field was constructed, using whole table tennis balls as the 4-pi spherical light collector. Two designs for simple meters to be used with selenium photocells are given--one based on an operational amplifier powered by two 9-volt dry cells and one a direct-reading log-ratio meter. The detector operates successfully down to a depth of 10 meters, and may be modified for deeper water use by filling the balls and detector head with a transparent oil. (Cassar-FRC)
W81-01873

7C. Evaluation, Processing and Publication

WATER RESOURCES OF THE COOK INLET BASIN, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
G. W. Freethey, and D. R. Scully.
Available from the Br. of Dist., USGS Box 25286, Fed. Ctr. Denver, CO 80225, Price: $6.00. Geological Survey Hydrologic Investigations Atlas HA-620, 1980. 14 Fig, 5 Tab, 33 Ref, 4 Sheets.

Descriptors: *Water resources, *Groundwater, *Surface-groundwater relationships, *Hydrogeology, *Alaska, Groundwater potential, Stratigraphy, Aquifers, Aquifer characteristics, Water yield, Geomorphology, Water resources development, Streamflow, Flow rates, Discharge(Water), Runoff, Regression analysis, Hydrologic data, *Cook Inlet(AK).

Ground-water and surface-water systems of Cook Inlet basin, Alaska, are analyzed. Geologic and topographic features that control the movement and regional availability of ground water are explained and illustrated. Five aquifer systems beneath the most populous areas are described. Estimates of ground-water yield were determined for the region by using ground-water data for the populated areas and by extrapolating known subsurface conditions and interpreting subsurface conditions from surficial features in the other areas. Area maps of generalized geology, Quaternary sediment thickness, and general availability of ground water are shown. Surface-water resources are summarized by describing how basin characteristics affect the discharge in streams. Seasonal trend of streamflow for three types of streams is described. Regression equations for 4 streamflow characteristics (annual, monthly minimum, and maximum discharge) were obtained by using gaging station streamflow characteristics and 10 basin characteristics. In the 24 regression equations presented, drainage area is the most significant basin characteristic, but 5 others are used. Maps of mean annual unit runoff and minimum unit yield for 7 consecutive days with a recurrence interval of 10 years are shown. Historic discharge data at gaging stations is tabulated and representative low-flow and flood-flow frequency curves are shown. (USGS)
W81-01671

COLUMBIA GLACIER, ALASKA: RECENT ICE LOSS AND ITS RELATIONSHIP TO SEASONAL TERMINAL EMBAYMENTS, THINNING, AND GLACIAL FLOW,
Geological Survey, Tacoma, WA. Water Resources Div.
W. G. Sikonia, and A. Post.
Available from the Br. of Dist., USGS Box 25286, Fed. Ctr. Denver, CO 80225, Price: $3.75. Geological Survey Hydrologic Investigations Atlas HA-619, 1980. 3 Sheets, 16 Fig, 13 Ref.

Descriptors: *Glaciers, *Hydrography, *Mapping, *Ablation, *Alaska, Bays, Ice, Icebergs, Calving, Movement, Ice-water interfaces, Discharge(Water), Aerial photography, Photogrammetry, Surveys, Hydrographs, Hydrologic data, *Columbia Glacier(AK), Glacier flow.

In 1974 the U.S. Geological Survey began an intensive investigation of the stability of Columbia Glacier, a calving tidewater galcier terminating in Columbia Bay, near Valdez, Alaska. Aerial photographs taken in 1957 and a sequence of photographs taken at about 2-month intervals since 1976, when analyzed photogrammetrically, provided detailed data on changes in Columbia Glacier's thickness, flow rate, and terminal position. Annual embayments in the glacier's terminus form during the summer-autumn season in most years; the size of embayments appears to be related to (1) the thickness of the glacier, and (2) the position and nature of subglacial freshwater discharge. Embayments have apparently increased in size in recent years; the largest embayments yet observed formed in 1975, 1976, 1977, and 1978. From April 1, 1977, to April 1, 1978, the total volume of ice calved was about 1.0 cubic kilometer. By January 1979 the glacier front had retreated from Heather Island. Glacier flow varies seasonally and synchronously in the lower 17 kilometers of the glacier; large accelerations occur near the terminus in response to embayment formation. Daily speed within 5 kilometers of the terminus increased from about 1.9 meters per day between 1963 and 1968 to about 2.7 meters per day between 1977 and 1978. In the lowest 15 kilometers, the glacier surface was lowered about 9 meters between 1957 and 1974, and about 13 meters between 1974 and 1978. Columbia Glacier is being reduced in mass due, in part, to recent losses caused by large embayments forming annually. If such reduction continues it will result in a drastic retreat. (USGS)
W81-01672

SUMMARY OF WATER-LEVEL AND DISCHARGE RECORDS FOR THE EAST EVERGLADES AREA, DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. J. Schneider.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $5.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File

Report 80-215, 1980. 33 p, 4 Fig.

Descriptors: *Data collections, *Surface waters, *Groundwater, *Florida, Sites, Water levels, Discharge(Water), Data storage and retrieval, *Dade County(FL), East Everglades area(FL).

Information concerning data collected and records maintained for 25 surface-water and 10 groundwater sites in the East Everglades area, Dade County, Fla., is presented. Listed are: location of sites, period of record, type of gage used, average discharge, and extremes for period of record. A history of records for each site includes the format of the data published and what data are stored in the U.S. Geological Survey computerized data system. (USGS)
W81-01673

WATER RESOURCES DATA FOR ALASKA, WATER YEAR 1979.
Geological Survey, Anchorage, AK. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-144818, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Data Report AK-79-1, November, 1980. 365 p, 4 Fig.

Descriptors: *Alaska, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1979 water year for Alaska consist of records of stage, discharge, and water quality of streams; stage and water quality of lakes; and water levels and water quality in wells and springs. This report contains discharge records for 111 gaging stations, stage only records for 2 gaging stations, water quality for 58 stations, and water levels for 30 observation wells. Also included are 62 low-flow, 89 crest-stage, and 24 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements of discharge, lake stage, or water quality. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alaska. (USGS)
W81-01677

WATER RESOURCES DATA FOR ARKANSAS, WATER YEAR 1979.
Geological Survey, Little Rock, AR. Water Resources Div.
Geological Survey Water-Data Report AR-79-1, October, 1980. 633 p, 5 Fig, 3 Tab.

Descriptors: *Arkansas, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1979 water year for Arkansas consist of records of stage, discharge, and water quality of streams and wells; stage, contents, and water quality of lakes and reservoirs. This report contains discharge records for 66 gaging stations; stage only records for 1 gaging station; stage and contents for 4 lakes and reservoirs; water quality for 151 stations, 51 partial-record flow stations, 7 lakes, and 5 wells; and water levels for 83 observation wells. Also included are 125 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Arkansas. (USGS)
W81-01678

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1979--VOLUME 4. NORTHWEST FLORIDA.
Geological Survey, Tallahassee, FL. Water Resources Div.
Geological Survey Water-Data Report FL-79-4, September, 1980. 686 p, 48 Fig, 1 Tab, 9 Ref.

Descriptors: *Florida, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Northwest Florida.

Water resources data for the 1979 water year in northwest Florida consist of continuous or daily discharge for 69 streams, periodic discharge for 28 streams, peak discharge for 23 streams and continuous or daily stage for 4 streams; continuous elevations for 4 lakes and periodic elevations for 30 lakes; continuous ground water levels for 41 wells and periodic ground water levels for 353 wells; quality of water for 37 surface water sites and for 95 wells. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State and Federal agencies in Florida. (USGS)
W81-01679

A CASE STUDY OF COMPUTERIZED INDUSTRIAL WASTE DATA,
Metropolitan District Commission, Boston, MA. Sewerage Div.
N. D. Baratta, G. H. Bollier, and P. E. Schafer.
Public Works, Vol 111, No 9, p 105-107, September, 1980. 1 Fig.

Descriptors: *Data storage and retrieval, *Industrial wastes, Data processing, Computer programs, Waste treatment, Treatment, Standards, Management, Boston(MA).

A computerized data management system has been developed for the Metropolitan District Commission Sewerage Division, Boston, Massachusetts. This program may be used to prepare reports as required by EPA or other agencies, for example, summaries of toxic substances discharged, industry listings, and spill detection lists. The computer program may be applied to many requirements for industrial waste pretreatment as listed in CFR 40, Part 403. Report options on industries may be in several forms: alphabetical by category, log number, SIC number, pretreatment construction status, municipal summary sheet, constituent code, mass emission (pollutants), and permit renewal. Future options include lists of industries by flow rate, disposal method, type of pretreatment, and violations. (Cassar-FRC)
W81-01887

8. ENGINEERING WORKS

8A. Structures

SEWER CONSTRUCTION BY SHIELD METHOD IN YOKOHAMA,
Sewage Works Bureau, Yokohama (Japan).
S. Miyakoshi.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 923-930, May, 1980. 8 Fig, 1 Tab.

Descriptors: *Sewers, *Construction, *Soil strength, Structural engineering, Earthworks, Design, Soil density, Performance, Shield method, Japan, *Yokohama(Japan).

The shield method of sewer construction was used in Yokohama (Japan) to construct sewers in damp, soft soil. A recent development is the controlled soil pressure shield, in which excavated soil is used to stabilize the face when adjusting the volume of discharged soil. A mud-slurry pressure shield has also been developed, in which the pressure of the mud slurry stabilizes the face while adjusting the volume of fed and discharged slurry. Examples are given of sewer construction in soft ground, the blind shield method, the mud slurry pressure shield method, controlled soil pressure shield method, and the shield method in a sandy layer with confined water. Shields which have been recently developed or improved are tail void filling, peat, gravel layer, and small diameter shields. In Yokohama, there are presently eight waste water treatment plants in operation and three more under construction, and the total length of sewers is 3160 km spread through hills and soft soil near the river. (Small-FRC)
W81-01766

UNIQUE DESIGN FEATURES OF KOBE'S WASTE WATER TREATMENT PLANT,
Japan Sewage Works Bureau, Kobe.
K. Nakai.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 955-960, May, 1980. 2 Fig, 1 Tab.

Descriptors: *Treatment facilities, *Costs, *Recreation facilities, Swimming pools, Activated sludge, *Waste water treatment, Odor, Activated carbon, Cities, Japan, *Kobe area(Japan).

The unique design features of the Tarumi waste water treatment plant and community center, the latest plant to be constructed in the densely inhabited (13,255 people/ha) Kobe area (Japan), are described. The plant servs 144,000 people and has a waste water volume of 54,720 cu m/day. The final effluent is discharged into the Seto Inland Sea after conventional activated sludge processing and dewatering. Dewatered cakes are disposed of at a landfill. The waste water treatment center is built beneath several swimming pools, tennis courts, a playground, and a parking lot. Offensive odors are carefully controlled at the plant, since it functions as a community center. Synthesized adhesive carbon absorption, active carbon absorption and ozone masking are used for odor control. Since its establishment five years ago, the center is used by about 1000 people a day. About 1000 swimmers a day use the pools, although there is an admission charge. The facility cost 195 million yen (210 yen = 1 US dollar in 1978) for the land, 5589 million yen for the treatment plant, 387 million yen for the Community Center, and 367 million yen for the various other facilities. (Small-FRC)
W81-01795

DESIGN OF MULTISTORY SETTLING TANKS IN OSAKA,
Japan Sewage Works Bureau, Osaka.
K. Matsunaga.
Journal of the Water Pollution Control Federation, Vol 52, No 5, p 950-954, May, 1980. 5 Fig, 1 Tab.

Descriptors: *Settling tanks, *Construction, *Design, Pipes, Weirs, Aeration, *Engineering structures, Land use, Multistory structures, Japan, *Osaka(Japan).

The construction of settling tanks two or three stories high or the installation of an aeration tank on top of a final settling tank have been planned for the efficient utilization of limited available land in Osaka, Japan. Special equipment is necessary for such facilities, including aeration equipment in the inflow conduit, perforated pipes or overflow weirs for outlet equipment, telescopic outlet pipes, and assembled-type outlet pipes. Sludge collectors tend to have chain wear on one side as the result of looseness or twisting, so the tension of the chain must be monitored. Aeration tanks are available that are assembled on final settling tanks, and assembled-type outlet pipes are necessary. Tests at a two story treatment plant demonstrated that effluent can successfully be withdrawn over triangular notch-type weirs for the upper tanks and through telescopic-type outlet pipes for the lower tanks. Assembled-type outlet pipes are used at the three-story Tsumori Sewage Treatment Plant to equalize inflow rate. (Small-FRC)
W81-01797

AGING URBAN WATER SYSTEMS: A COMPUTERIZED CASE STUDY,
Betz, Converse, Murdoch Inc., Plymouth Meeting, PA.
D. K. O'Day, C. M. Fox, and G. M. Huguet.

Public Works, Vol 111, No 8, p 61-64, 111, August, 1980. 2 Fig, 3 Tab.

Descriptors: *Water distribution(Applied), *Lateral conveyance structures, *Aging(Physical), Data processing, Evaluation, Leakage, Durability, *New York, Public utilities, Water conveyance, Surveys, Performance, Urban areas, Conduits, Pipelines, Deterioration, Surveys.

An engineering and computer analysis of the New York City water distribution system was performed to study the relationship between water main breaks and the structural integrity of the water mains. The study evaluated the causes of all main breaks, identified any discernable patterns or trends in breaks, and recommended measures to alleviate water main break problems. The methodology developed for this study can assist water system managers in making sound decisions about pipe replacement during the course of roadway reconstruction or utility work. Also, the methodology can be used to plan five or ten years ahead. The study found that New York's system is not wearing out because of age and there is no evidence that the cast iron pipes are deteriorating. Small diameter mains had the highest breakage rate due to bedding problems. These bedding problems are often caused by leaks. Location seemed to be the single most important factor in breakage; a 19th century system cannot meet 20th century stress. (Small-FRC)
W81-01877

TREATMENT STRUCTURE SUPPORT OVER DIFFICULT SOILS,
Associated Pile and Fitting Corp., Clifton, NJ.
H. W. Hunt.
Public Works, Vol 111, No 9, p 131-134, September, 1980. 5 Fig.

Descriptors: *Soil engineering, *Water storage, *Piles(Foundation), Waste storage, *Engineering structures, Concrete piles, Timber piles, Construction materials, Design criteria.

Support structures over difficult soils are considered. Structures must be free of settlement if they are to be used for waste water handling to prevent contaminants from seeping out of cracks or causing additional damage to the initial structure. Design limitations should require no more than 1/2 inch differential settlement between tanks or structures. Good design requires dependable borings to provide subsurface information and to enable the builder to gain adequate and current information. Various types of piles are considered, including the non-displacement H-pile, precast concrete piles, composite piles, and timber piles. In planning the construction at least one boring should be made for each 2,500 square feet of space. Standard sampling spoon procedures should be used and blows recorded. All information concerning subsurface conditions must be made available to prospective bidders. (Baker-FRC)
W81-01880

PROBLEMS OF CORROSION CONTROL IN WATER DISTRIBUTION SYSTEMS,
L. M. Applegate.
Public Works, Vol 111, No 7, p 54-57, July, 1980. 3 Fig.

Descriptors: *Corrosion control, *Cathodic protection, Water distribution(Applied), Water delivery, Coating, Pitting(Corrosion), Pipes, *Pipelines, *Water conveyance, California, *Oroville(CA).

Corrosion control problems encountered in the water system of Thermalito Irrigation District in Oroville, California, are described. The district is served by a small reservoir, a good well and a filtration plant. A 20-inch main with lateral branches extends a few miles from the filtration plant, and here occasionally leaks have occurred. A cathodic protection system has been installed to protect against such leaks. Cathodic protection for the system was established in two parts. A 2 million gallon flat bottomed water tank at the filtration plant was the site of the first cathodic protection. Second, a 50-volt, 50-ampere rectifier and a large anode bed in a heavy gravel-soil pasture east of the tank were built. The soil resistivity there was typical of good agricultural soils, 2500 ohm-cm. Use of small multiple rectifiers and small anode beds, characteristic of gas line protection, are recommended for use in water systems, as they would tend to equalize the potentials on adjacent water and gas lines. Interference would be lowered and could be eliminated. (Baker-FRC)
W81-01883

THE TRINIDAD WATER PROJECTS,
CH2M/Hill International, Corvallis, OR.
L. A. Dove.
Public Works, Vol 111, No 7, p 69-72, July, 1980. 5 Fig.

Descriptors: *Construction, *Water supply development, Design standards, Design, Water supply, Water demand, Water delivery, Water yield improvement, *Trinidad.

The development of a US$250 million water supply and transmission system for the island of Trinidad is reviewed. The first phase involved design and construction of the Navet dam, reservoir, and pumping station, and expansion of the treatment plant serving critical areas in central and south Trinidad. The system's capacity was increased from 14 mgd to 23 mgd. The second phase is the Caroni-Arena Project, a 100 ft high seasonal storage dam, a 72 mgd Caroni water treatment plant, and a water transmission system to serve areas west of Port-of-Spain and southwest to San Fernando. The third phase is the Interim Water Supply Project, which is currently relieving water problems in north Trinidad in the short-term. In a period of 10 years the Republic of Trinidad and Tobago will have tripled its available water supply and will continue to grow to serve increasing numbers of customers with good quality water. (Baker-FRC)
W81-01892

8B. Hydraulics

IMPROVED IMPLICIT PROCEDURE FOR MULTICHANNEL SURGE COMPUTATIONS,
Hydro and Power Authority, Vancouver (British Columbia).
K-H. Kao.
Canadian Journal of Civil Engineering, Vol 7, No 3, p 502-512, September, 1980. 18 Fig, 4 Tab, 4 Ref.

Descriptors: *Model studies, *Tailrace, *Open channel flow, Mathematical models, Channels, Equations, Computer programs, British Columbia, Peace River, Finite element analysis, Surges.

When the explicit finite difference technique is applied to solve the equations for unsteady open channel flows, the duration of each time step is restricted by the Courant condition. Often the time step becomes too small for efficient computation. To overcome this problem, a method of numbering the computation points along a system of waterways is proposed. When the system is composed of many channels and each branch watercourse is assumed to be one-dimensional, the proposed numbering technique will generate a narrow diagonally banded coefficient matrix of simultaneous equations. An IBM computer program (GELB) may be used to solve the system of simultaneous equations. This yields a significant decrease in computing time as well as a reduction in computer storage requirements. The procedure was applied to the Y-shaped channel of the tailrace system of Portage Mountain Development on the Peace River in British Columbia. Computed and hydraulic model tests results for this system showed close agreement. (Geiger-FRC)
W81-01779

8C. Hydraulic Machinery

WINTER ICE REMOVAL FROM STOCK WATER PONDS,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
J. E. Garton, T. Ghermazien, and K. Robinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-167207, Price codes: A03 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University Project Completion Report, September, 1980. 34 p, 18 Fig, 6 Tab. OWRT-A-086-OKLA(1), 14-34-0001-9038.

Descriptors: *Ice-water interfaces, *Melting, *Cattle, *Stock water, *Hydraulic equipment, Water circulation, *Farm ponds, Potable water, Ice, Ice cover, Climatology, Freezing, Ice breakup, Water sources, Domestic animals, Livestock, Ruminants, Trawling, Motor generators, Pumps, Pump testing, Turnovers, Pumping, Thermal stratification, Bodies of water, Ponds, Water holes.

The purpose of this study was to find a practical, reliable, and inexpensive method for melting ice on farm ponds during the winter to allow livestock accessibility to water. An alternative means of removing ice from the near-shore surface of ponds was found, rather than requiring that farmers/ranchers routinely chip holes in the ice. The performances of two methods were tested: (1) use of an electrically-operated submersible pump; and (2) a wind-electric generator directly connected to an electric trolling motor, to stimulate conditions in remote locations lacking electricity. By either technique, warmer water from greater depths was circulated to the surface of the pond. A water jet was directed upward at a 45 degree angle towards the shore in each of three ponds studied. It was concluded that, with electricity available, submersible pumps would be more economical than use of an electric trolling motor, trickle charger and battery, due to equipment and maintenance costs of the latter system. For remote ponds with no available electricity, the wind-electric plant can be directly connected to the trolling motor; refreezing of the hole on calm days resulted in only relatively thin ice cover that could be broken by cattle. (Zielinski-IPA)
W81-01651

AN INEXPENSIVE INSTRUMENT FOR MEASURING SOIL WATER TABLE LEVELS,
Department of Agriculture, Saint-Jean (Quebec). Research Station.
J. A. Campbell, J. A. Millette, and M. Roy.
Canadian Journal of Soil Science, Vol 60, No 3, p 575-577, August, 1980. 2 Fig, 1 Tab, 1 Ref.

Descriptors: *Water table, *Water level recorders, Instrumentation, Water measurement, Soil water, On-site tests, Metal pipes, Hydraulic structure, Plastic pipes, Potentiometers, Observation wells.

A simple and inexpensive instrument for measuring soil water table levels is described. The apparatus is an improvement upon previous implements because it overcomes the problem of metal contamination of water samples from the use of metal wells. The new instrument, which may be used with metal or plastic wells, features a probe which is inserted into a well, and a meter box. The probe is made of CPVC pipe with a vinyl tape epoxied to the outside of it. A two-conductor instrument cable bifurcates to form two electrodes which are soldered to prevent corrosion from acid soil water. A two-connector phono plug is connected to the other end of the cable. The meter components are diagrammed, and calibration procedures for the instrument are given. Accuracies of the measurements are within + or - 1 mm, and field and greenhouse tests with the new device have given very reliable results. (Geiger-FRC)
W81-01780

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